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OBSTETRIC MEDICINE AND SURGERY

VOL. II.



A SYSTEM

OF

OBSTETRIC MEDICINE AND SURGERY

THEORETICAL AND CLINICAL

FOR THE STUDENT AND PRACTITIONER



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VOL. II.

SMITH, ELDER, & CO., 15 WATERLOO PLACE 1885



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CHAPTER I.

LABOUR.

THE PROCESS OF PARTURITION: EXTRUSION OF THE FŒTUS; EXTRUSION OF THE PLACENTA.

Labours are divided into—1. Spontaneous; 2. Artificial. Other divisions are stated: we think this is the most simple and comprehensive, but subdivisions are necessary.

- 1. Spontaneous labours are those which are terminated by the natural forces. They are easy or propitious, falling under the head of $Eutocia-\varepsilon \hat{v}$, well, $\tau \acute{o} \kappa os$, a labour; or laborious and difficult, falling under $Dystocia-\delta v\sigma$ -, bad, $\tau \acute{o} \kappa os$, labour.
- 2. Artificial labours are those in which recourse is had to art. The artificial labours thus all fall under the head of Dystoeia.

Again, labours may take place at term, that is, at the end of ten lunar months; or prematurely, that is, at any time after the fœtus has attained viability. In the latter ease the labour may be either spontaneous or artificial.

What is the natural term of gestation? This question has been discussed rather than decided when studying the question of the Duration of Gestation (see vol. i., p. 306).

What is the Cause of Labour?

A problem full of interest: many solutions, each perhaps containing a part of the truth, have been put forth. We might ask the eognate question: Why does the ripe apple fall to the ground? It looks like begging the question to answer: It falls because it is ripe. The explanation of many of the phenomena of Nature is searely more satisfactory. We may trace more or less completely the sequence of natural phenomena without being able to fathom final causes. Labour may be regarded as

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an ultimate fact, the expression of a law, some of the moving factors of which are unknown to us. We may, however, usefully state what is known or reasonably conjectured.

The causes of labour are efficient and determining.

The efficient causes. It was at one time thought that, like the escape of a bird from its shell, the exit of the child from its mother's womb was partly effected by its own exertions. It is only necessary to recall the fact that a dead child may be expelled from the womb. That life in the child favours easy labour, and that a dead child may impede labour, is true. When the child is living, its movements excite the healthy action of the uterus, and the uterus responds more readily to the natural excitation, because it and the nervous and vascular systems are in the fulness of physiological tension and activity. On the other hand, when the fœtus has been dead some time, the nervous and vascular supply in the uterus and the centric irritability are diminished, and the inert mass of the fœtus is incapable of giving the healthy stimulus to contraction. The loss of tonicity of the fœtus permits it to be rolled up into a ball, so that the pressure is not brought to bear effectively upon the two points of chief irritability, the fundus and the cervix. Thus a dead feetus may be a cause of dystocia; but it does not follow that a live child is an efficient cause of labour.

The real efficient causes of labour are—1. The contractions of the uterus; 2. The contractions of the abdominal muscles.

Now what are the determining causes: those which provoke the uterus to contract to expel its contents?

A. Causes proceeding from the fætus. Towards the end of gestation its movements are more active, and then act upon an organ whose irritability is intensified. The fætus has a share in the provocation of labour.

B. Causes proceeding from modifications of the ovum. Druitt, J. Y. Simpson, Schræder, and others contended that towards term a partial detachment of the ovum took place as the consequence of fatty degeneration of the decidual element of the membranes. We cannot assent to this, because we doubt the fact of the precedent detachment, and the postulated fatty degeneration. This subject has been discussed under the Diseases of the Placenta (see vol. i., p. 549). In this view we are supported by Langhans, Dohrn, de Sinéty, and Leopold. This

last author, however, advances a new hypothesis.¹ He says the decidua reflexa and the serotina, and even the decidua vera, become thinner and thinner towards the end of gestation. He confirms Friedländer in the proposition that there is a constant and normal spontaneous formation at the end of gestation of venous thromboses in the muscular wall of the uterus near the serotina and in the serotina itself. These thromboses obstruct the veins affected; hence collateral hyperæmia and stasis of the maternal blood returning from the placenta. Leopold then asks if this is not one of the causes of labour, since Brown-Séquard showed that the irritability of the uterus increases constantly with the advance of pregnancy, so that at last the presence of carbonic acid, a strong excitant of contraction, in the maternal blood would suffice to provoke labour.

C. Determining causes proceeding from the maternal organism. Scanzoni affirms that from the eighth month the uterus is developed by distension, and no longer by hypertrophy. This stretching would in the end so irritate the organ, that it would contract upon the ovum to expel it. He agrees with Tyler-Smith, who argued that ovarian nisus at the tenth month determined an increased afflux of blood to the uterus, and thus provoked labour.

Brown-Séquard insisted upon the great increase of development of the venous system towards the end of gestation, thus bringing a larger volume of carbonic acid into contact with the irritable muscle.

Recent observations upon the behaviour of the neck of the uterus in gestation, to which we have already referred (see vol. i., chap. vii.), suggest another theory. We have seen that the neck of the uterus softens from below upwards; (2) that painless contractions of the uterus are going on throughout gestation; and (3) that during the last fortnight of gestation the softening of the cervix having invaded the whole structure, the os internum opens to increase the capacity of the uterus. Now it is argued that so long as the softening is limited to the lower part of the cervix, the draggings of the uterine muscle have no effect in opening the inner os, and thus of bringing the ovum into contact with the lower part of the cervix; but that when the softening has invaded the whole cervix, then the

¹ Die Uterussehleimhaut während der Schwangerschaft, &c.

uterine contractions act effectively, open the os internum, and thus bring the ovum into contact with the lower zone of the cervical canal. This provokes active contraction, and labour is determined. This is the view taken by Stoltz and Bandl. It recalls the hypothesis set forth by Power (1819), and since taken up by Dubois and Depaul. These authors contend for complete analogy between the expulsion of the product of conception and the excretion of urine and fæces. The structure may be compared to that of the bladder and rectum. All, in fact, are composed of a dilatable reservoir, and an irritable sphincter composed of circular fibres. When the contents of the cavity come to press upon the sphincter, reflex contractions are excited. But the direct irritation of the sphincter is not enough to bring these contractions into play. The distension of the reservoir itself and the resulting dragging of the muscular fibres concur in producing them.

It appears to us that the arguments advanced by Tyler-Smith are too strong to be set aside. The great law of Periodicity which rules menstruation is never suspended. We have already compared menstruation with labour. Regarding labour as the equivalent of menstruation, or its substitute, we should naturally expect it to take place at what would be a menstrual epoch. Calculation proves this to be true in a great number of instances. We see the same periodical ovarian influence at work in determining abortion and premature labour.

We should then sum up the determining causes of labour in a group of factors, acting synergetically, or in necessary connection of sequence, as follows: Maturity of the ovum; changes going on in the placental tissues; thrombosis in the muscular wall of the uterus; accumulation of carbonic acid in the blood supplying the uterus; softening of the cervix, ending in pressure of the ovum upon the lower segment of the uterus and cervix; growth of muscular tissues of the uterus and increase of uterine and centric irritability; stretching of the uterine muscle; and lastly, ovarian irritation, which, returning at the epoch of highest tension, causes the final explosion of nervous force, the effect of which is labour.

There are three factors in Labour:—1. The body to be expelled; 2. The expelling force; 3. The resisting force. A. R. Simpson describes these alliteratively as—1. The passenger; 2. The power; 3. The passages.

The Process of Parturition.

The term of gestation completed, certain phenomena announce the advent of labour. In many women labour sets in suddenly. In others, perhaps the greatest number, especially of primiparæ, certain precursory or premonitory signs, subjective and objective, are observed: 1. The first in order of these is the sinking of the fundus of the uterus, which takes place from eight to fifteen days before labour. Upon this, some women experience great, almost sudden relief: digestion is more easy, breathing is, freer, movements are brisker. Others are differently affected: they are less disposed to exertion, and feel a sense of weight in the lower abdomen, on the rectum and bladder, attended by tenesmus, diarrhea, and frequent micturition; 2. The venous circulation of the lower limbs and genitals is more embarrassed; the vulva swells. 3. Slimy discharge, yellowish or white, flows from the vagina. This mucus is sometimes streaked with blood, due to the detachment of the caduca or chorion from the lower segment of the uterus. This appearance, or 'show,' as it is called, is a common indication of labour being at hand. 4. At the same time, the latent contractions, which have attended the whole course of gestation, become more frequent, stronger, and the woman experiences a sense of constriction, of tightening in the lower abdomen and loins. These constrictions sometimes become painful several days before labour. Premonitory pains may come on in paroxysms, lasting an hour or more, exciting false alarm and untimely calls upon the doctor.

At last parturition declares itself, and we observe a series of physiological phenomena. These are five. (1) The contractions of the uterus and abdominal muscles; (2) the dilatation of the os uteri; (3) the formation of the bag of membranes and its rupture; (4) the escape of blood-streaked mucus; (5) the dilatation of the vagina, perinæum, and vulva. These phenomena do not occur in an isolated manner. They form two groups, which answer to two distinct periods of labour. The first period begins with labour and lasts until the os uteri is fully dilated; this is the period of dilatation. The

second period begins at the end of the first and ends with the extrusion of the fœtus; this is the period of expulsion. The third period is marked by the extrusion of the placenta; this is the placental period.

1. The uterine contractions. During gestation the contractions are feeble and painless. They become energetic and painful at the time of labour. Contraction is a strictly physiological act, and is not normally attended by pain. Pain is the consequence and expression of resistance. As in defection and micturition, if the expulsive effort and the resistance are accurately adjusted, and if the structures of the contracting organ and of the sphincteric orifices are healthy, the function is performed without pain. In some typical women labour is actually carried through without pain. Some describe the process as no worse than ordinary defecation; others have actually been delivered during sleep.

It is important to bear this in mind, for although pain is the ordinary lot, and is often an important physiological factor, as Marshall Hall and Tyler-Smith explained, it is in its essence pathological. And in this fact lies the justification of the use of anæsthetics. It is by a metonym, then, that, confounding cause and effect, we speak 'of pains' when we mean expulsive contractions. Pain depends mainly upon two conditions-First, the susceptibility of the subject; secondly, the state of the expelling and resisting structures. If these structures are hyperæmic, inflamed, the seat of morbid action or deposit, or are unusually rigid, then pain is proportionally

developed.

The contraction is revealed by other signs than by the subjective one of pain. When the contraction occurs, if we place the hand upon the anterior surface of the abdomen, the uterus is felt to harden. This hardening is felt some time before the pain declares itself, and often one may thus announce to the woman that a pain is coming on before she is conscious of it; and when the sense of pain has gone, the uterus still remains hard for a little while. Again, we realise the existence of contraction by vaginal touch; thus we find that the os uteri is more rigid during the contraction; that at the moment of contraction the bag of waters is distended and starts through the os; and if the membranes are ruptured, there flows at the

commencement of the contraction a small quantity of liquor amnii.

Under the influence of the contraction the uterus changes situation and shape. Usually inclined to the right, it comes nearer to the median line, whilst the fundus and anterior wall are carried forward against the abdominal wall which is raised up by it. When the abdominal muscles come into play, the fundus uteri is carried back against the spine. This result has been directly verified on mammifera by vivisection; it is due partly to the contraction of the broad ligaments and especially of the round ligaments. The muscularity of these ligaments, demonstrated by Rainey, has been proved to increase at the menstrual epochs and during gestation.

The shape of the uterus is changed. Under concentric contraction it would become spherical but for the resistance of the feetal ovoid. Thus, when the feetus loses its resistance under decomposition, it becomes compressed into a ball under the uterine contractions, and the uterus is spherical. But under normal conditions the form assumed is cylindrical. The anteroposterior diameter is elongated, the transverse diameter is contracted; the longitudinal diameter ought to be lessened also, but by virtue of a force which Schatz calls the force of restitution of form, it elongates. In fact, the uterine pressure, determined by the contraction, causes the fœtus, curved on its anterior plane, to straighten itself, and thus to increase the height of the feetal ovoid. This reacts upon the walls of the uterus; on one side it pushes back the fundus of the uterus, which presents during the contraction an arch corresponding to the breech of the fœtus; on the other side it rests by its inferior pole, that is by its head, upon the lower segment of the uterus. At the end of labour the fœtus maintains this new erect attitude, even during the intervals of contractions. Thus, according to Braune, at the beginning of labour the length of the uterus is about 26 cm., increasing by 6 cm., or nearly 2.40 in., beyond its length before the onset of labour and the beginning of the period of expulsion. Hence, during labour, the shape assumed by the uterus is cylindrical, not spherical.

In ordinary labour the contractions are general, not partial They embrace the whole organ. But they are not ab initio

general; they invade the different regions of the uterus successively, that is, in peristaltic order, as Tyler-Smith contended, spreading from above downwards, or, in some cases, anti-peristaltic, spreading from below upwards, as Kehrer described. The movements are rhythmical.

The uterine contractions are *involuntary*. The parturient woman cannot produce them, suspend them, accelerate or retard them, *Moral emotions*, however, influence them. Fear retards, confidence restores them.

An essential character of uterine contractions is their intermittence. They return at nearly regular intervals if observed during the like stage of labour. But the intervals which separate two consecutive contractions are of very different duration at the different stages of labour. At first the intervals average about twenty minutes; during the dilatation stage they return every ten minutes, and even towards the end every five minutes; and during the expulsive stage every two or three minutes. But there are great variations. Sometimes the contractions are suspended, or accelerated, or slowed without ascertainable cause. Sometimes it seems as if the tired uterus took rest, and then acted again with vigour. Intermittence is the general law which governs the contractions of all the muscles of the body. Like the heart, the uterus is subject to this law.

The duration of the contraction is variable in all the stages. Generally it is shorter at the outset than at the end. At first it lasts thirty seconds, then rises to sixty seconds, it rarely exceeds one hundred seconds.

In some abnormal cases the contractions become *continuous* and tetanic.

What is the *intensity* of the contractions? It varies at the different stages. It is greater during the stage of expulsion, and at the end of the stage of dilatation, than at the beginning of this stage. As a general rule the contractions are stronger as the labour advances, unless they remit, in consequence of the exhaustion of the uterus. But then the labour is pathological and *uterine inertia* ensues. Intensity and frequency of contractions mostly go together. The closer the contractions follow each other, the greater is their intensity.

The contractions follow in pairs, that is, a strong contraction is followed by a feeble one. The intensity varies during the same contraction. There is a stage of increase, a stage of maximum, and a stage of decrease. The three stages of a contraction constitute the *systole*, the interval of rest the *diastole* of the uterus.

Attempts have been made to estimate in figures the intensity of the uterine contractions, or the force required in labour. Poppel, Matthews Duncan, Haughton and Ribemont-Dessaignes tested this by the force required to rupture the membranes, assuming that this force represented nearly the intensity of the uterine contraction.

The experiments of Poppel made on a piece of membrane 10 centimetres in diameter gave a mean bursting pressure of 6·162 kilogrammes, those of Duncan on membrane 112 millimetres in diameter gave a mean pressure of 7·587 kilogrammes, ranging from 2 to 18 kilogrammes; those of Ribemont-Dessaignes, conducted with special care, on an orifice of 10 centimetres found the average bursting pressure to be 10·300 kilogrammes. Joulin estimated the highest contractile power of the uterus at 100 lbs.

Haughton ¹ found that the involuntary or uterine force equalled 3·4 lbs. on the square inch, and that of the voluntary or abdominal force equalled 38·6 lbs. on the square inch, giving a maximum expulsive force of 42 lbs. 'Calculating the feetal head to have a diameter of $4\frac{1}{2}$ inches, this would represent the enormous force of 593 lbs., or about a quarter of a ton, which might be engaged in parturition. He, of course, was aware that only a small proportion of this power was usually exerted.'

Duncan thinks the maximum expulsive power of labour, including the uterine contractions, with the assistant expulsive efforts, do not exceed 80 lbs. The difference between the two estimates creates distrust in the accuracy of their experimental methods. Duncan's estimate accords best with clinical observation.

But these estimates are quite untrustworthy. They are too variable to justify any definite conclusions; the conditions of the experiments differ essentially from those obtaining in labour; the membrane is dead tissue, and thus less resisting

¹ Dublin Med. Press, 1870.

than live tissue; it is tied to a rigid ring; whereas in nature the membrane is continuous, and is forced against a yielding and elastic ring; the force is applied by nature in recurrent impulses, which may be imagined to test the resisting power gradually, sparing the full impetus until the due moment of bursting has arrived. These different conditions vitiate experiments conducted on this plan. It is moreover certain that the bursting force of the membranes thus found is below the force required to expel the child, and therefore inadequately represents the expulsive energy of the uterine contractions. Speigelberg also says that all the experiments upon the resisting force of membranes are invalidated by great fallacies. The point illustrated by these experiments is simply the resisting power of a piece of dead membrane.

Schatz pursued a totally different plan. He measured the expulsive force by means of an apparatus called the tocodynamometer. It works something like a sphygmograph. By this he estimated that pressure exerted at the end of labour by the uterus and abdominal contractions varied from 17 to 55 pounds. It must, however, be observed that this does not represent the simple pressure of the uterus upon the membranes, but the combined pressure of all the expulsive forces.

Dr. Poullet, of Lyons, used an apparatus similar to that of Schatz,² called the *tocograph*, which enabled him to differentiate the uterine from the abdominal pressure.

There is a strictly clinical test by which we may confront these experimental observations and estimate their value. Thus children weighing from 5 pounds, or less, to 18 pounds, are expelled by the natural forces. The parturient lying on her side, there is no help from gravity, and friction has to be overcome. This last factor, no doubt, varies; but it is in many cases considerable; and it gives an unknown quantity to be added to the child's weight. We may safely assume that Schatz's estimate is not exaggerated. The range is accounted for by the variable factors of weight and friction. The expulsive force is regulated by the resisting factors. Nil natura frustra facit holds here. The force adapts itself to the resistance. It rarely is in excess, it more often falls short;

¹ Beiträge zur physiologischen Geburtsk. (Archiv für Gynäkologie, 1873.)

² Tarnier et Chantreuil.

and then we have lingering labour that has to be helped by artificial force applied à fronte or à tergo.

We may formulate this law: The propelling or driving

force in labour is the measure of the resisting forces.

The character of the pains differs in the different periods of labour. During dilatation the pains are irritating, depressing. The woman seems to suffer without making progress. In the period of expulsion, the pains are more acute, but they are better borne; they give the sense of stretching, and even of tearing. Very painful indeed, but they are attended by a consciousness of progress; 'they do good.' The woman bears them with courage, and is cheerful in the intervals. Sometimes the relief obtained on the cessation of the pain is so complete that the patient falls asleep until the next pain awakens her.

The seat to which the pain is referred varies. During dilatation they are often felt in the sides of the uterus or in the loins; later they radiate around towards the pelvic region and the lower segment of the uterus. To escape them the woman often changes her posture, flexing the trunk upon the pelvis and thighs, so that the feetus may bear less directly upon the os uteri. Depaul says lumbar and sacral pains are chiefly observed when the presenting part is kept at a distance from the orifice, as from pelvic deformity or presentation of shoulder or face.

Pains are sometimes felt which are called 'false pains,' in order to distinguish them from the true or efficient pains of labour. False pains have variable seats; sometimes in the abdominal walls, sometimes in the intestines, associated with dyspepsia, diarrhea, or retention of fæces or of urine. In these cases the uterus does not contract; or if there be some reflex contraction it is partial, and produces no effect upon the os uteri. These were called by Power 'metastatic pains.' The nervous energy is diverted from its proper use.

Uterine contractions and pain affect the fætal and the maternal circulations. Effect upon the fætal circulation. If the stethoscope be applied during a pain the fætal heartbeats are observed to become slower. They are slowest when the contraction is at its acme; they recover gradually during the decrease of the pain, and regain their full frequency and

force during the diastole of the uterus. The probable cause of this slowing is the interruption to the utero-placental circulation under the compression of the vessels in the uterine wall. Kehrer and others attributed it to the compression of the fœtal brain. The latter hypothesis is excluded by observations made by Robert Barnes.¹

He watched the circulation of the heart in cases where the fœtus expelled from the mother still retained its connection with the placenta. At every contraction the pulsations slowed, and rose again as the contraction remitted. In the same cases when feeble respirations were exerted the pulsations rose exactly as they did when the placental circulation was restored during uterine diastole, and were slowed again when respiration flagged. He thus obtained demonstration that respiration and placental circulation were equivalent in promoting the action of the heart. That the slowing cannot be caused by compression of the brain is proved (1), by the fact that it is observed before the membranes are ruptured, that is, whilst the head is protected from compression by the liquor amnii; (2), by the fact that the slowing is observed after the child is born, and thus removed from uterine compression. McClintock and Hardy observed that the feetal heart's action was depressed under the contractions excited by ergot, and that, if these were long-continued, the heart might cease to beat altogether. But it is possible that ergot may exert a direct toxical influence on the fœtus by entering its blood.

2. The influence of contractions and pain on the maternal circulation. Pain, if sudden and severe, causes a degree of shock which will depress the heart's action. But in the ordinary conditions, the contractions and pain are attended by acceleration of the pulse. Hohl declares that the relation between these two phenomena is so intimate that, if the quickening of the pulse is gradual, reaching its maximum little by little, maintaining it for a certain time, then gradually declining, the contraction also is pursuing a regular course; if, on the contrary, the pulse quickens by starts, the contraction is short and hurried.

The modifications imparted to the uterine souffle under
London Hospital Reports.

contraction are described by Tarnier. At the beginning of the contraction the souffle becomes suddenly stronger, more snoring, then gradually, as the contraction increases in intensity and becomes general, the souffle diminishes and becomes imperceptible; as soon as the contraction weakens, the souffle returns with all the characters it manifested at the beginning of the contraction, and recovers its habitual sonorousness. These observations furnish further proof that it is by interrupting the placental circulation that the feetal heart is slowed.

Abdominal contractions. The abdominal muscles seldom come into play until the advanced stage of labour, when the fætal presenting part has cleared the os uteri, and is engaged in the vagina. As Tyler-Smith has shown, 'at the time when the liquor amnii is discharged, and the os uteri becomes fully dilated, the motor force of parturition is applied in quite a new direction. The direction in which the fœtus has now to pass is in that of the axis of the lower part of the pelvis, which is forwards and downwards. It is at this point that the expiratory muscles come into play, particularly the abdominal muscles, and the new direction is provided for. Before the dilatation of the os uteri, we had to consider the fœtus as an ovoid mass, and the axis of this ovoid corresponded with the axis of the uterus. After the dilatation, we may speak of two axes of the fœtus—one, the axis of the head, in its long or occipito-mental diameter; the other, the axis of the body of the fœtus. Now, the axis of the head, in a natural presentation, becomes nearly the same as the axis of the outlet of the pelvis, through which it has to pass; and the feetal body being flexible, readily passes as it descends from the direction of the superior to that of the inferior pelvic axis. The uterus acts under greater advantage when the membranes are ruptured. The same circumstance is equally favourable to the action of the abdominal muscles. A further adaptation becomes visible in the precise time at which the liquor amnii is discharged. When the bulk of the uterus is increased by the liquor amnii in addition to the fœtus, the abdominal muscles are so distended that they can only act with difficulty. But after the diminution of the size of the uterus by the discharge of the waters, the abdominal muscles are more free to act, and it is now that they are called upon to aid in the expiratory actions which propel the head through the vagina. . . . The contractions of the abdominal muscles are so powerful as to be no inconsiderable stimulus to the uterus itself. Thus in this stage, when the uterine contractions flag, they can sometimes be renewed by voluntary contractions of the

expiratory muscles.

'But,' continues Tyler-Smith, 'there is a cause for the intervention of the respiratory system, as well as the sign of its utility. In the stage of dilatation, the ovarian and uterine nerves were the chief amongst the excitor nerves of the motor actions which then occurred. As soon, however, as the feetal head, protruding through the os uteri, begins to press upon the vaginal surface, a new set of excitor nerves becomes implicated. The vaginal excitor nerves are the excitors of the expiratory actions of parturition. As long as the internal surface of the uterus alone is irritated, the uterus contracts by itself; but as soon as the vagina is impinged upon, the expiratory force is brought to bear. Another point worthy of observation is, that the excitor nerves of the uterus, except at the extreme dilatation of the os uteri, when the stomach is disturbed, are chiefly in connection with the lower portion of the spinal marrow; but the vaginal excitor nerves are in relation both with the lower medulla and the medulla oblongata. By the lower medulla, and the excitor and motor nerves in relation with it, reflex actions of the uterus are produced by excitation of these nerves; while all the reflex actions of the respiratory system depend upon the medulla oblongata. If the spinal marrow were divided in the middle, there would probably be no respiratory action in parturition, unless the pneumogastric can act as an excitor during labour. Voluntary efforts, and the forcible efforts of emotion, are often mixed up with the pains; but the respiratory acts of this stage of labour are truly reflex in their nature. The expiratory actions occur during the insensibility of puerperal convulsions, when emotion and volition are both suspended. If they were not reflex and physical in their nature, the exhaustion following a strong labour would be far greater than it is. It is a principle of reflex action that it induces no fatigue. (This proposition requires modification.) Hence we see even weak women making powerful efforts, but perfectly refreshed between the pains, and easy and composed after several hours of severe labour.'

Tyler-Smith thus describes the motor phenomena of the contractile part of a pain in the propulsive stage. 'At the coming on of each pain, the patient takes a deep inspiration as a preliminary. Expiration then takes place slowly and forcibly in a succession of gasps, and when the air in the thorax is diminished, it is suddenly removed by hasty inspirations. Each pain consists, as far as the respiratory muscles are concerned, of several sudden and deep inspirations, followed by prolonged and laborious expiratory efforts, with the glottis partially or entirely closed. At the acme of a pain, the glottis and cardia are entirely closed, the glottis only opening partially at intervals, and the abdominal and extraordinary muscles of expiration being forcibly contracted. The diaphragm remains inert, as in vomiting, with the actions of which phenomenon, except that the cardia is closed instead of opened, the efforts of the expiratory muscles in labour may be compared. . . .

'Besides these actions which are involuntary and reflex, the patient voluntarily aids in fixing the thorax by holding some fixed body with her hands, or planting her feet firmly. More than this, she increases all the expiratory actions by strong efforts of the will, and by that emotion of labour which impels her to brave every suffering to effect the birth of the child. At length when the pain can no longer be borne, the short gasp or groan is exchanged for a cry which dilates the glottis, and the pain and contractions subside. This cry is a motor action, excited by the emotion of pain, and instantly relieves the uterus of all extra-uterine pressure. Thus the glottis may be compared to a safety-valve. . . . By the influences of volition we have this valve entirely under our control, to open or close it, as may be necessary.'

This opening of the glottis under the emotion of pain is

the illustration of the physiological use of pain.

The final act of expulsion, to quote again from Tyler-Smith, 'is the shortest of the whole progress, but it is the most important and decisive. The actions of the propulsive stage continue with unabated vigour. The uterus contracts with full power, and the respiratory muscles act with immense force. The intervals between the pains diminish as the close of the struggle approaches; and there is often a perfect storm of uterine contraction, without sufficient intermission to enable us

to say distinctly where one pain ends and its successor begins. When the feetal head is actually passing, a new set of actions make their appearance. The perinæum, after being distended to the utmost, is now retracted over the head by the action of the levatores ani; the sphincter ani and the sphincter vesicæ dilate suddenly, the vagina contracts upon the advancing mass, and the head glides rapidly into the world. The dilatation of the two sphincters, between which the vagina is placed, compensates admirably for the absence of a perfect sphincteric muscle at the outlet of the parturient canal. The effect of this double dilatation is that at the precise moment when there is the most imminent danger of laceration, there is a sudden diminution of tension from the parts endangered. The dilatation of the sphincters is partly dependent on the sensation and emotion of severe pain, and partly on the reflex dilatation peculiar to the sphincteric muscles. This explains the defecation which frequently occurs at this time, and which has been looked upon only as a disagreeable contretemps. (The relaxation of the sphincter ani is an undoubted factor, but the more efficient cause of the defecation is, we believe, the pressure of the advancing head upon the rectum, by which the contents of this canal are squeezed out.) At the same moment that the orifices of the rectum and bladder are thrown widely open there is generally a dilatation of the glottis. Its effect is suddenly to take away the expiratory pressure from the expulsive action. Without this combined action of the glottis and the sphincters of the rectum and bladder for the defence of the ostium vaginæ, recto-vaginal laceration must be a much more common accident of parturition.'

3. Indications furnished by the bag of membranes.

The 'bag of membranes' technically means that part of the sac of liquor amnii which presents at, or protrudes through, the os uteri externum. This normally forms in the first or dilatation stage, appearing as the os dilates. It is indeed one of the forces which effect the dilatation of the lower segment of the uterus and the cervix. If the head presents, and the balance of the parturient factors is preserved, this bag usually advances unbroken until the dilatation is far advanced. It undergoes gradual distension and thinning preparatory to bursting.

During a pain the bag becomes tense and more protruded,

so that the encircling os uteri is felt as a tight ring upon its circumference; during the uterine diastole, the capacity of the uterus increasing, the waters ebb back into its cavity and the bag of membranes becomes flaccid, and sinking upon the head it may even become not easy to distinguish. The feeling the flow and ebb of the waters in their containing bag gives therefore indication of the alternate systole and diastole of the uterus. So long as the bag of membranes remains intact, the action of the uterus is necessarily spent upon the contained fluid, exerting little or no pressure upon the fœtus. Under the hydrostatic law of fluid-incompressibility the fluid seeks to escape, and this it does by the most yielding gate, that is, the os uteri, which is forced open by it. Three great functions of the liquor amnii in labour are exercised simultaneously-the fœtus is protected from pressure, the placental circulation is maintained, and the cervix uteri is dilated. When the cervix is dilated the bag bursts, and the passages are prepared for the safe transit of the fœtus. The uterus, now aided by the expiratory muscles, presses upon the fœtus and propels it onward.

The significance of the various forms presented by the bag of membranes. The presenting part of the fœtus may be presumptively diagnosed by the characters of the bag of membranes. If the bag is flat and expanded, the waters forming a thin stratum, the probability in favour of a cranial presentation is great. This probability rises if, during the diastole, the finger can easily press back the membrane upon an expanded hard rounded body. In some breech presentations the characters of the bag of membranes are similar, but less marked. On the other hand, when the bag is protruded slowly in a cylindrical shape, and no part of the fœtus is felt presenting above it, the inference is justified that some abnormal presentation, as a foot, cord, or shoulder is presenting. This form is also produced when, the cervix dilating slowly, the presenting part cannot enter the pelvic brim, whether the cause be malpresentation, or undue size of the fætal head, or malformation of the pelvis. Moreau further pointed out that it was liable to be produced by obliquity of the uterus.

Tarnier describes a *pyriform* character, as when the membranes make a kind of bladder in the vagina, and a constricted .

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part at the level of the os uteri. This is frequently observed when the fœtus has perished during gestation.

In cases of twins there may be a double bag of membranes, but most commonly one bag presents at a time.

When the placenta presents, the part of the membranes reached is thick and rough, and one may sometimes trace a margin into the spongy mass of the placenta.

When the membranes rupture, the flowing liquor amnii is useful in lubricating and mollifying the vaginal canal. But the vagina does not depend upon the rupture of the bag for its lubrication. The membranes are permeable to fluid under pressure. Tarnier and Pinard demonstrated this important fact by three series of experiments. In the first they stretched a piece of the membranes taken from an ovum recently delivered over one end of a glass tube which was then filled with water. After some hours droplets of water were found on the outer surface of the membrane. Some water had therefore oozed through. This is not the same thing as osmosis. In a second series they used liquor amnii. The result was the same. In the third series they subjected the contained fluid to pressure. Some fluid quickly oozed through.

Membranes vary in permeability. The amnion is more permeable than the chorion lined with the caduca. In these experiments it was found that a certain quantity of fluid gathered between the amnion and chorion, forming a true amnio-chorial sac. A similar condition may be observed in practice. Thus, after having ruptured the chorion and let out some liquor amnii, the amniotic sac is still felt distended under uterine contractions, and in its turn has still to be ruptured. It is important to recognise these false or secondary bags of liquor amnii. We occasionally observe considerable discharges of water preceding by some hours or days the bursting of the membranes. These discharges may be due to the formation of such false inter-membranous bags. But this explanation will not apply to some cases. Similar rapid and copious watery discharges occur early in pregnancy and in nonpregnant women. They are the result of active glandular secretion from the cervix uteri.

The transudation of liquor amnii through the membranes is a provision of accommodation to reduce excessive tension, and to postpone to the due time the rupture of the sac, and perhaps to avert rupture of the uterus.

The rupture of the membranes. The membranes commonly burst all at once. Sometimes the amnion bursts first. Ribemont-Dessaignes has made many interesting observations, chinical and experimental, on this subject.\(^1\) Sometimes the bursting is delayed until the sac is protruded beyond the vulva, the presenting part of the child being born covered or capped by the membranes. When this happens the child is said to be born with a caul. This caul is endowed by superstition with the virtue of preserving its possessor from drowning, and there are people who in this faith will give money for a caul.

Sometimes, again, the membranes do not rupture at all, but the ovum is expelled entire. In such cases the fœtus is in danger of perishing from asphyxia and drowning. As soon as the placenta is separated from the uterus, the fœtus makes an inspiratory effort, and will not long survive without air. Whenever this event occurs, it is therefore important to rupture the sac quickly to extricate the child. And if we have the opportunity, the membranes should be ruptured when they present at the vulva.

In not a few cases the membranes burst prematurely, that is, before the dilatation of the cervix. The labour may in consequence be retarded, but this is not necessarily the case. If the labour is at term, and the presentation is of the vertex, neither mother nor child may suffer. But in presentations of the trunk or shoulder, the escape of the waters permits the uterus to compress the fœtus, and the operation of version is made much more difficult.

No definite time elapses between the bursting of the membranes and the birth of the child, but usually expulsive action sets in vigorously and effectively.

Mode of discharge of the liquor amnii. This may be effected silently and slowly, or rapidly and with noise. The first mode is observed in head presentations. When the membranes burst, a moderate quantity only flows at the time. The head, carried down upon the cervical ring, blocks it; when the diastole occurs, the head, like a ball-valve, recedes, and more liquor amnii escapes. But not seldom a considerable quantity

¹ See Tarnier and Chantreuil.

remains ponded up in the upper part of the uterus until the child is expelled, when it is discharged in a gush.

The liquor amnii is more apt to be voided quickly and entirely when the presenting part is not the head.

The gradual evacuation of the liquor amnii must be regarded as one of the provisions of accommodation which regulate the several factors of labour, and which maintain the action in due relations of time and force.

Useful indications may be drawn from the characters of the liquor amnii. To observe this it is a good plan to catch the liquor which flows at the first gush in a small bowl. We thus get a fair sample, and avoid much soaking of the bed. The ordinary appearance of the liquor is that of a clear or slightly turbid yellowish citron colour. Sometimes it is turbid and dark green from meconium. This, although due to premature evacuation of the child's intestine, commonly taken to be the result of an inspiratory effort, is quite compatible with the expectation of a living child. But it may serve as a warning that aërial respiration has become necessary; and delivery should be expedited should no serious contra-indication be present. This meconium-stained liquor amnii is not uncommon in breech-labour.

Not seldom we hear of cases in which the membranes are said to have burst days and weeks before true labour. The reality of the bursting may well be doubted. Some of these apparent ruptures are examples of the rupture simply of the chorion and of the escape of fluid which had collected in a false sac between it and the amnion, this latter membrane remaining intact. Other cases are examples of the rapid secretion of watery fluid from the mucous membrane of the cervix, and perhaps of the vagina. And, in some cases, an involuntary escape of urine has been mistaken for liquor amnii. In these cases it has nearly always been noted that the membranes burst again at the due time, discharging the due quantity of liquor amnii, or even more. It has been supposed that the membranes, having ruptured, may reunite, the amniotic sac being re-integrated; or that a large quantity may transude under pressure through the unbroken membranes. Distinct proof of these hypotheses is wanting.

Premature escape of fluid in considerable quantity often

gives a false alarm of impending labour. The physician determines the significance of such discharges by examination. If he finds no evidence of uterine activity by external exploration, and no marked or progressive dilatation of the cervix uteri, he may conclude that labour has not fairly set in, and may safely retire to await another summons.

4. The 'show,' or escape of blood-streaked mucus. Closely connected with the formation of the bag of membranes, and often preceding it in time of observation, is the muco-sanguineous discharge called 'the show.' We have before called attention to the copious creamy matter which covers the vaginal portion and upper part of the vagina during pregnancy. This is not a glandular secretion, but is strictly the result of rapid exfoliation of the pavement-epithelium of these parts under active hyperæmia. Besides this, the enlarged glands of the uterine neck secrete a thick viscid mucus which collects in the cervical cavity, forming a gelatinous plug. At the commencement of the stage of dilatation portions of this mucus escape. This will stick to the examining finger, or may be passed spontaneously, and spot the linen. Generally it is yellowish or plum-coloured. The colour depends upon the proportion of blood mixed with it. Sometimes the blood is seen in streaks. Slight blood-tinging is attributed to the separation of the chorion from its connection with the uterus through the decidua. Minute vessels are torn across.

Tarnier connects this mucous discharge with the liquor amnii which oozes through the membranes before their rupture. It thus acquires new properties; it becomes more unctuous, more running, and more fit to lubricate the external genitals. This, says Tarnier, is so true, that if we find the vagina scarcely moist when we examine, we may almost affirm that labour is but little advanced; and on the contrary, if the vagina is well lubricated, permitting the introduction of the finger easily, without the aid of a fatty body, it is very probable that the os uteri is already well-dilated.

5. The expansion of the vagina, perinæum, and vulva has been described in its motor phenomena. It remains to describe some features in the last stage of dilatation of the cervix uteri and of the perinæum in their bearing upon the mechanism of labour, which were very imperfectly appreciated before Robert

Barnes' views were published.1 Towards the end of the dilatation stage, especially in primiparæ, the axis of the uterus approaches co-incidence with the axis of the pelvis, its lower pole pointing to the middle of the sacral hollow. This relation causes the centre of the expanding os uteri to be opposite the sacral hollow, with its posterior margin directly under or even above the sacral promontory, according to the degree of dilatation, whilst the anterior margin of the os will be carried close to the sacral hollow, the anterior wall of the lower segment of the uterus capping the child's head. It thus happens that on examining at this stage, the finger, carried in the axis of the pelvic outlet, does not enter the os uteri, but impinges upon the anterior part of the lower segment of the uterus, bulged out by the head. To find the os, the finger must travel far back,. and then curve forwards under the promontory in order to find the anterior edge of the os (see fig. 1, uu) and enter the cervix. On referring to the diagram, it will be seen that the anterior part of the lower segment of the uterus forms an inclined plane in the pelvis, which necessarily guides the head into the sacral cavity so as to clear the promontory, thus describing 'Barnes' curve.' In the typical normal pelvis this curve is slight, but it is always a factor in determining the course of the head. Where the promontory projects unduly, this curve assumes greater importance. This disposition of the anterior wall of the lower segment of the uterus, Robert Barnes calls the first, or anterior, or uterine valve (see fig. 1, uv). It is sometimes carried down before the head to the very floor of the pelvis, so as to touch the second or perineal valve-(fig. 1, pv), which we will now describe. The head fairly in the pelvic cavity, the uterine valve has done its duty and ought to retreat. It usually does so, being drawn up behind the symphysis. The head then has only the vulva to traverse. It now encounters a second plane or valve, formed by the perinæum, or floor of the pelvis. This, regarded as an extension of the lower or forward curve of the sacrum and coccyx, rules the axis of the outlet of the pelvis, which is the route the head must take. Continuing expulsive efforts bearing upon the child's spinal column, the head is extended and is directed under the symphysis in Carus' curve through the outlet. Thus the uterine

¹ Obstetrical Operations.

valve or plane guides the head into the pelvis; the perineal valve or plane guides the head out of the pelvis by the axis of the outlet.

When the head reaches the pelvic floor, it enlarges the outlet first by pushing back the coccyx, secondly by depressing and distending the fleshy prolongation of the pelvic canal, transforming it into a channel along which the head is guided. All the tissues forming the pelvic floor are stretched; the recto-vaginal septum is pushed against the rectum, which it

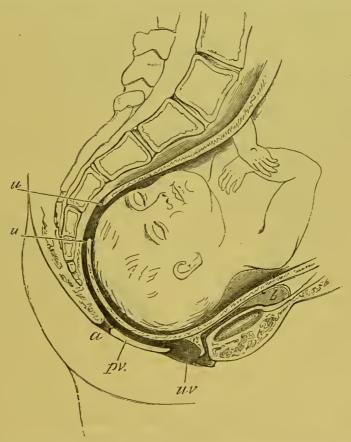


Fig. 1.—Showing the two valves which successively oppose the advance of the head. uv. First or uterine valve. pv. Second or perincal valve. uu. Os uteri. b. Bladder.

flattens; the anus, often surrounded by a rim of hæmorrhoids, is widely opened, so that the mucous membrane of the anterior wall of the rectum is exposed. When the head is bulging out the perinæum, the stretching open of the anus is often so great and the tissues are so thinned that the finger may easily pass into the anus under mistake for the vagina. Sometimes

the edge of the anus eracks under the distension, and troublesome fissures result.

When the expulsive action subsides, the head, which may have bulged in part between the labia vulvæ, retreats, and the perinæum becomes flaccid. This retreat of the head is often ascribed to the elasticity of the external soft parts, which earries the child up again towards the abdomen. The true reason is found in the relaxation of the uterus and abdominal museles,

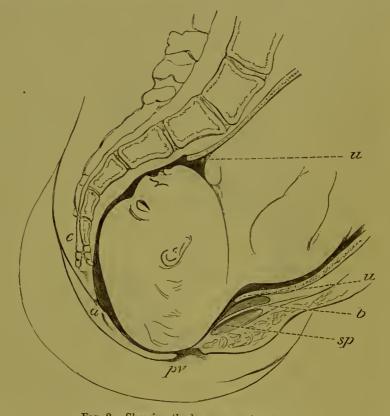


Fig. 2.—Showing the lower or perinæal valve.

a. Anus. b. Bladder. c. Coccyx retropulsed. sp. Symphysis pubis. uu. Uterus.

pv. Perinæal valve.

the aetion of atmospheric pressure, and the suction power of the abdomen. After the child is born, this vacuum or suction force is very manifest. Air may be drawn into the uterus if the woman lies in the prone posture, and the perinæum is held back. This fact supplies an argument in favour of the dorsal position, with the shoulders slightly raised. Thus the uterus permits the fœtus to fall back a little into its cavity, and the enlarged abdominal cavity receives the uterus, the pelvis being pro tanto relieved. When the uterus and abdominal muscles again contract, the uterus and fœtus are again propelled against the perinæum until at last the head is driven through; the perineal valve or plane is carried back, slipping over the face. In primiparæ the anterior edge of the perinæum, the fourchette, is almost invariably torn.

Barnes' uterine and perinæal planes or valves are identical with the pubic and sacral segments of the pelvic floor described by Hart and Barbour (see vol. i., p. 157.)

The process of the third or placental stage of Labour, or, as

Tyler-Smith called it, the supplemental stage.

While the body of the child is born by the motor actions described, the contracting uterus follows closely upon it in its descent, and the action of the uterus, excited at this time from the immense irritation of the vagina by the advancing fœtus, is frequently sufficient to throw off the placenta, and lodge it in the upper part of the vagina. When the placenta is not cast in this way by the last expulsive pain, it remains quietly in the uterus until the appearance of the first after-pain. During this interval the uterus contracts with tolerable firmness. the placenta has been expelled into the vagina, its presence here excites after awhile bearing-down pains and contraction of the vagina, similar to those of propulsion and expulsion, only far less considerable. The vagina may be regarded as a musculoelastic canal; it tends to contract when emptied; but its contractile power is, if not paralysed, greatly weakened by the enormous distension it has recently undergone; and the body it has to contract upon, the placenta, is soft and plastic, easily moulding itself in the bag which the vagina forms; it is not solid enough to be easily driven forward, so that commonly some adjuvant force is necessary to effect its removal. This may be applied à tergo by compression of the uterus, as will be described hereafter, or à fronte, by traction upon the cord and placental mass.

The child and placenta expelled, contraction is still imperatively needed to secure against hæmorrhage. The hæmostatic process will be particularly described when treating of post-partum hæmorrhage. Here it is enough to state that when the placental separation is effected, the abraded surface

of the uterus is strongly excitor; and as the placental mass passes through the vaginal passage and ostium vaginæ, excitation which insures full uterine contraction is supplied. It is a character of the utero-vaginal canal that at the end of labour all the surfaces are more actively excitor, and the answering motor contractions become more rapid and more easily provoked. During severe labour irritation of the os uteri or of the vagina will often increase the pains in a moderate degree, but now the introduction of the hand will excite instant and forcible contraction of the uterus. The extra-uterine excitors of uterine action also come into play in a remarkable manner. Slight irritation of the mammary excitor nerves excites distinct contractions of the uterus. Drinking even bland fluid will act in similar manner. Emotion from thinking of the child will generally produce an after-pain. And it is under reflex excitation of this kind that continuous contraction is kept up, promoting involution and the return of the uterus to the ordinary state of a non-motor organ.

The duration of Labour varies in different and even in the same subjects. Comparing, in the first place, natural labours only, we find first that the average duration is greater in primiparæ than in multiparæ. Notwithstanding the great nervous and muscular energy usually found in young primiparæ, the resistance opposed by the soft parts is absolutely and relatively greater. The uterine muscle is not so well developed, its power is less. Counting the commencement of labour from the first pains, it may be stated generally that the duration is from twelve to fifteen hours; that the stage of dilatation is about equal to that of expulsion. It is commonly said that primiparæ advanced in age, that is at forty or more, suffer more protracted labours. This is generally true; but marked exceptions are not rare.

Hereditary types of labour are observed. Through several generations slowness or rapidity of labour has been noted.

In pluriparæ the average duration is about seven or eight hours, and the stage of expulsion is often shorter than that of dilatation. The expulsive energy may be as great as, or greater than, in primiparæ, whilst the resistance is both absolutely and relatively less. The quickest labours may be expected in young women parturient for the third, fourth, or fifth time;

when parturient for the ninth or tenth time, and approaching forty years of age, the labour may be more protracted.

Influence of Station in Life, Race and Climate, upon the duration of Labour.

It is generally believed that in hot countries labour is quicker than in cold. But we are not aware of any exact data bearing upon this point. The tales told of women of barbarous races bringing forth without pain and without danger must not be hastily accepted as universally true. Trustworthy reports assure us that protracted, difficult, even fatal labours are not unknown amongst them. It is certain, however, that women brought up in luxury and idleness have to undergo more protracted labours than have women brought up in the country and inured to hard work.

The influence of Labour upon the Maternal Functions.

The principal functions undergo certain modifications usually transient under the influence of the uterine contractions. nervous disturbances are the most constant and the most various. At the outset there is commonly some sense of anxiety, which quickly disappears as the pains follow with regularity. Then, as the orifice dilates, a degree of agitation is observed. Frequently a rigor sets in; this is reflex; a similar phenomenon is observed at the commencement of micturition even in men. About this time vomiting is not uncommon. It is attended by relief. There is an old adage amongst women that 'sick labours are safe.' In some women a temporary delirium occurs, especially at the acme of the expulsive stage. Generally, however, the nervous susceptibility lessens as the expulsive stage advances. The store of nervous energy is concentrated upon the focus of physiological activity, where it is healthily utilised. During labour women not seldom complain of cramps, referred to the upper and inner side of the thighs, or even to the whole length of the lower limbs. The first kind are due to the compression of the obturator nerve by the fætal head; the second to the compression of the sciatic plexus by the head. Cramps along the inner side generally of one thigh are often complained of by women towards the end of pregnancy.

¹ Labour among Primitive Peoples. Englemann, 1883.

Robert Barnes, many years ago, registered the statements on this point of women applying to be attended during labour, and found that he could predict the position of the head by noting which thigh suffered. Thus the left thigh cramps foretold a first occipito-anterior position, and right thigh cramps the second position. Similar observations hold good during labour.

The *circulation* is accelerated, the pulse becomes stronger as well as quicker. Arterial tension is increased.

Calorification is modified. The heat of the body is raised; the thermometer applied to the armpit, mouth, or vagina indicates a higher temperature than at the end of gestation. The thermometer placed in the uterus itself indicates a still higher temperature. This is accordant with the physiological law that increased physiological action entails a richer supply of blood and rise of temperature. This phenomenon is called local hyperthermia. Peter, Schroeder, Winckel, and Hennig found that the temperature in the uterus during labour was higher than in the vagina, and that it rose during the contractions. Grüber observed that the rise in temperature was very slight in normal labour, but very marked in abnormal labours. We must bear in mind that the observations were mostly made in lying-in hospitals, where prevailing conditions often disturb the normal processes. But making due allowance for this source of fallacy, it may be accepted that there is a real rise of general temperature during labour, and a special rise in the uterus during contraction.

In some cases the skin remains dry and hot during labour, but often it is bathed in perspiration. The face becomes red, the tongue pale and rather dry. These phenomena are especially pronounced when the dilatation stage is protracted.

Respiration is modified. The movements are increased. Winckel says 3 the increase is as 20.7 to 18.7 in the minute. They are more frequent during the intervals between the contractions. During the expulsive contractions, when the respiratory muscles are called into action, the glottis being closed, the movements are necessarily suspended.

¹ Schwangerschaft, Geburt und Wochenbett, 1867.

² Klinische Beobachtungen zur Pathologie der Geburt, 1869.

³ Loc. cit.

Modifications of the Functions of the Fætus produced by Labour.

The phenomena presented by the circulation have been already described when studying the effect of the uterine contractions.

Respiration. During gestation the fœtus makes no respiratory movement. Respiration and its attendant nutritive processes are carried on by osmosis, that is, by gaseous and liquid interchange between the maternal blood and the fœtal blood in the placenta. This goes on during labour. But if the placental function is unduly interrupted, inspiratory efforts are made, under which meconium may be voided into the liquor amnii, and some of this fluid may be drawn into the air-passages.

Occasionally, when the membranes are burst, if the face presents, or if the obstetrist has passed his hand into the uterus to practise some manœuvre, air may be conducted along with it, and reaching the child, may be inspired by it; and thus a phenomenon which has been much contested may arise. This is—

Vagitus intrà-uterinus. On expiration the fœtus still, in utero or in vagina, may utter a ery. The possibility of this has been doubted. Velpeau, with pithy cynicism, said: 'Since educated men, worthy of faith, say they have heard it, I believe; but if I myself had heard it, I would not believe.' And, indeed, it is one of those things that demand close, intelligent, and repeated observation to earry conviction. Certain it is that sounds easily misinterpreted by unskilled and impressible minds are heard which are not due to this cause. A little air getting into the uterus or vagina has given rise to sounds which we have known the bystanders to attribute to the child, yet the child has been dead.

The evidences upon which we rest our belief in the reality

of vagitus uterinus are these:

1st. The proofs now generally accepted that the fœtus in utero makes real inspiratory efforts when the placental circulation is interrupted.

2nd. The fact that air may find its way into the vagina and

uterus and come into contact with the child's face.

3rd. The fact that during the diastole of the uterus there is a degree of suction force towards the cavity, and such relaxation of the uterus, that the chest walls of the child may readily expand.

4th. The fact, which we and others have verified, that when the face presents, and is still at some distance from the vulva, air admitted to the vagina reaches the child's face, and is inspired. In these circumstances we have heard the child cry, and the vaulted chest when born shows that it had breathed Indeed, in these circumstances, breathing has been maintained either by keeping a finger or a tracheal tube in the child's mouth.

If air can thus enter the child's lungs when the face is in the vagina, it is reasonable to infer that it may do as much when the face is still in the cavity of the uterus.

Lastly, there is the evidence of authority, positive evidence of men not open to the impeachment of ignorant credulity, and too multiplied to be set aside by sceptical negation. Amongst the witnesses to the fact are Marc, Baudelocque the younger, Depaul, Winckel, to whom we may add ourselves. Several of the instances recorded have been cases of foot or shoulder presentation, where the hand was introduced into the uterus for the purposes of turning or extraction.

The Management of Simple Labour.

WHAT TO OBSERVE IN THE PARTURIENT WOMAN.

- 1. The aspect and general condition.
- 2. Pulse, respiration, temperature.
- 3. Feel the abdomen, to estimate size, firmness, movements of uterus, position of uterus; also the changes in these conditions during the pains.
- 4. Inquire as to pains, their seat, order of recurrence, duration, intervals. Note the discharges, mucous, blood, watery.
- 5. Vaginal examination. Lubricate the fingers with carbolised vaseline, 1 in 30.

The first thing to determine is: the reality of pregnancy; the next is: the reality of labour. Note the time of beginning of opening of the os uteri. This marks the beginning

of the first stage of labour. These points settled in the affirmative, the finger takes note of the condition of the vulva, of the vagina as to lubrication, dilatability; of the os uteri, its position; is it open? if so, to what degree? is it dilatable? does it alter during a pain?

The presentation: this should if possible be made out; the bag of membranes: does it bulge during the pains? is it thick, resisting, or thin? is it still entire or burst? Catch the liquor amnii in a bowl; inspect it; is it limpid, turbid, pale or discoloured? note the quantity.

Stethoscopic observation may be applied to the feetal heart.

So far there is little to do beyond observing the course of events, and sustaining the courage of the parturient. Care should be taken to secure the emptying of the bladder. A little light nourishment may be given. If pain be urgent, a sedative draught of 15 minims of laudanum may be given. If the patient or her friends call out for chloroform, evade complying during this stage. The continued presence of the physician during this stage is not necessary, but when dilatation is fairly progressing in a pluripara it is wiser to keep within call.

During the premonitory stage, or if not then done, during the dilatation stage, it is useful to empty the bowels by enema; the subsequent progress of the labour is facilitated, and annoyance to patient and physician is avoided.

The main duty of the physician is to take care that no undue interference or meddling is practised. Especially the parturient should be enjoined not to attempt 'to help herself' by forcing efforts. These do not advance the labour, and only exhaust the patient's strength.

Take care that no ergot or other oxytocics be administered.

Take care not to rupture the mcmbranes.

Note the time at which the mcmbranes rupture. This marks the beginning of the second stage of labour.

Observation is now directed to the advance of the presenting part; the rotation and other adaptive movements.

The formation of the caput succedaneum or corresponding swellings in presentation of parts other than the head.

Note the condition of the woman as affected by the labour;

pulse, respiration, state of skin, rigors, injection of face, or pallor? vomiting? defecation?

Note the capping of the child's head: 1, by the uterine valve; 2, by the perinæal valve; the condition of the vulva and perinæum; the rotation and extension of the presenting part.

Observe the evolution of the child during its birth.

Note the state of the child when born: sex, development, alive or dead; feel the cord, feel the thorax for heart-beat, observe aspect of face, cyanosed or pale; are limbs limp or flexed upon trunk? Respirations, character of.

The plastic deformations, i.e. shape of head; are cranial bones entire?

From the beginning of this stage, as a rule the patient, if a pluripara, should not leave her bed; in the case of a primipara, however, if the pains flag, she may get up and walk about a little at intervals. This has the effect of awakening the uterine contractions, and lessening the tedium of expectation.

Sometimes, when the head is bulging the perineum, the woman feels an imperious want to relieve the bowel, and she may try to get on the night-stool. This should on no account be allowed. We have known the child to be precipitated into the stool, the cord broken, and the child in danger of drowning in the contents of the stool. And there is no slight danger to the mother of hæmorrhage and inversion of the uterus.

The care of the perinæum. It has been much disputed whether the perinæum should be 'supported,' or left to take care of itself. We believe there is now a general consensus or opinion in favour of supporting the perinæum. The question, therefore, is simply when to do it, and how to do it.

When to support the perinœum. It is of no use to begin before the head is distending the vulva. All pressure upon the pelvic floor before this time is waste trouble, and injurious by contusing the parts. Besides, as Tyler-Smith pointed out, pressure upon the perinæum may excite uterine contractions, and thus disturb the due order of the parturient process. The proper time to give support is when the head is gliding on through the vulva, stretching the perinæum, thinning it out, so that it threatens to burst.

How to support the perinaum. During the expulsive stage a finger is applied from time to time to the head and

carried back to the edge of the perinæum to take note of the advance of the head, and of the degree of stretching of the perinæum. When this is great, and increasing before the advance of the head, support duly rendered may help in two ways: first, the palm of the hand, so spread out as to rest upon the coccyx behind and upon the pelvic floor, prolongs and strengthens the pelvic floor, retarding the too precipitate exit of the head, giving the soft tissues time to stretch; and by directing the head under the pubic arch, excess of pressure upon the edge of the perinæum is avoided; secondly, by pushing forward skin from behind and the sides, the capacity of the perinæum is somewhat increased. Support is given during the pains, and remitted during the intervals, to enable the circulation to be restored. Free lubrication with vaseline or oil, and occasionally fomentations, make the dilatation more easy.

Laceration of the perinœum may begin in two ways—first, and most commonly, by tearing at the extreme edge, and then the rent may extend backwards in the median line, splitting up the pelvic floor to the edge of the sphincter ani or through it, or the rent may run laterally; secondly, the perinæum, bulging out in the middle, may burst at this part, and the rent may run forward through the fourchette and backwards through the sphincter ani; or the child may be driven bodily through the central hole, the edge of the perinæum keeping entire. The child performs a feat similar to the circus feat of leaping through a hoop covered with paper.

It is obvious that the extended palm of the hand, well supporting the pelvic floor, will obviate this latter accident; and that lengthening the perinæum forwards, and directing the advancing head well under the pubic arch, will much lessen the risk of tearing at the edge of the perinæum.

When the occiput is turning up under the pubic arch, the hand of the obstetrist grasping the head, steadily pushing it forwards, may greatly aid the extension movement. If want of driving power is observed at this time, steady pressure upon the fundus of the uterus will, by propagated force along the child's spine, still further assist the propulsive and extension movements. Until the stage of expulsion is advanced the posture of the patient is not very important. She may seek case by varying it. But when the head is engaging in the

vulva, the period of final crowning, the posture assumed may favour or lessen the risk of the perinæum being torn. Whether the posture be dorsal, as in France, or the left lateral, as in Eugland, the knees should be flexed upon the abdomen and held slightly apart during the evolution of the head. The parturient instinctively assumes this posture. It takes off a little tension from the perinæum, and briugs the pelvic axis into more favourable relations for the passage of the head.

The perinæum may still be ruptured by the stretching of the shoulders if these be driven through abruptly; the perinæum should, therefore, be supported during this stage.

Playfair, not without reason, objects to the term and practice of 'supporting the perineum,' and proposes to substitute 'relaxation of the perineum.' This is effected by the manœuvre described of pushing the skin of the perineum and external labia forwards and towards the median line. The perineum is thus supplemented and rendered less rigid. Goodell puts a finger in the rectum and draws the structures in front forward, so as to relax the fourchette.

The cord. As soon as the head is born it is proper to pass a finger round its neck to discover if the cord be coiled around it. If this is the case there are two ways of dealing with it. First, if the head is stationary, and the cord be not tightly embracing the neck, a gentle attempt may be made to draw the encircling loop forward over the occiput and head, so as to liberate it. But should there be any difficulty in executing this manœuvre, it is better not to lose time, which may involve two distinct calamities—first, strangulation of the child; secondly, dragging by the shortened cord upon the placeuta and uterus, thus disposing to rupture of the cord at the placental end, or detachment partial or entire of the placenta, leading to hæmorrhage; or, if the placenta remain adherent, possibly to inversion of the uterus. At any rate, the normal course of labour will probably be disturbed.

The simple, prompt, and effective escape from these accidents is to cut the cord at the most convenient point. This done, and holding the two cut ends, a ligature may be applied to each to meet the possible complication of a second child in utero drawing its blood-supply from a common placenta, the vessels of the two feetuses anastomosing. The improbability of

this event is so great that it might perhaps safely be disregarded. Another event is more probable—blood may escape from the feetal end of the cord, and thus endanger the child. In the great majority of cases, the head having emerged and the chest quickly following, air is drawn into the lungs, the circulation assumes the course determined by aërial respiration, and the blood-current is turned off from the umbilical vessels. Still, if we cannot tie both ends of the cord—we must tie both because we cannot tell which is in communication with the feetus—it only remains to expedite the delivery of the trunk, so as to tie the cord near the umbilicus in the usual way. This is done by gentle traction upon the head by the hands, aided by 'expression,' that is, by compressing the fundus and sides of the uterus.

There is no need to tie the placental end of the eord unless we suspect twins; the little blood that oozes from it does not come from the mother; it is simply that part of the fetal blood which circulated in the placenta.

The third stage. The cord is tied. The proper time for tying it.

Feel above pubes, state of uterus, and contractions.

Ascertain state of bladder.

Trace cord into vagina to ascertain if its insertion is within reach.

Observe state of woman, pulse, respirations.

Flow from vagina, hæmorrhage.

Trace state of uterus after expulsion of placenta; is there a second child?

The placenta is cast out or expressed.

Examine placenta minutely. Is it entire, as to its cotyledons and membranes? observe relation of rent in membranes to nearest margin of placenta; how did placenta pass out of vulva, edgewise, or like a reversed umbrella, membranes covering maternal surface? Does it show signs of disease, fatty, calcarcous, or other tissue change? Form; relation of insertion of cord to placental circle; is placenta single, diffuse, or does it show stray eotyledons?

Examine vulva and perinæum; intact or torn, extent of injury; thrombus.

The parturient becomes a puerpera. The binder is applied.

The Management of the Third Stage of Labour. Physiological Hæmorrhage of Parturition.

The third stage of labour consists mainly in the extrusion of the placenta. Security against hæmorrhage and against septicæmia depend largely upon the proper management of this stage. The conduct to be observed must be based upon the recognition of the events which take place. The following conditions are observed in healthy labour:

1. Immediately following the extrusion of the child there is a fall of nerve-tension and fall of vascular tension, a kind of physiological shock, not usually marked by depression, but rather by a state of gentle lassitude and a sensation of relief that a great and trying function has been accomplished. The rapid discharge of nerve-force during the stormy struggle of expulsion is followed by a calm that lasts for several minutes. This calm is necessary for the recovery from the shock, for the restoration of nerve-force which is wanted for the extrusion of the placenta and the contraction of the uterus. Immediately following upon the contraction which expels the child the blood-flux hitherto attracted towards the uterus to nourish the child is diverted from the pelvic vascular system. The separation of the placenta from the uterine wall begins with the expulsion of the child. The strongest contractions of the uterus commonly fail to separate the placenta so long as the child is retained in the uterus, unless it be in breech presentations. The separation is effected by the rapid loss of relation between the area of the placenta and the area of the uterine surface to which it had grown. The superficial area of an average placenta may be stated at 70 square inches, and of course the superficial area of the uterine surface to which it adheres corresponds. But when the uterus contracts, the area of placental attachment is suddenly reduced to about 19 square inches. Thus the placenta is cast off.

This contraction of the uterus is attended by another event. The volume of blood prepared for the nutrition of the child, placenta, and uterus is now superfluous. It has to be disposed of. This is done as follows: the uterus contracting, the blood contained in the sinuses is forced out into the cavity of the uterus.

The blood so discharged may be called 'the physiological hæmorrhage of labour.' Another portion of maternal blood, that contained in the placental cavernous structure, is thrown off with the placenta; at the same time the intra-uterine arteries being closed, the blood brought to the uterus is turned aside into the general circulation. The effect of this last process is to raise somewhat the arterial tension.

Generally the detachment of the placenta is completed, or nearly so, by the final contractions which expel the child. But it is often retained for a while in the uterine cavity. During this retention the uterus necessarily remains bulky; its placental area is not reduced to the minimum, and some further loss of blood may take place. But, presently, the nerve-force gradually gathered up in the stage of rest is called into use. The presence of the placenta in the uterus rouses the dormant diastaltic function, and renewed contractions set in. The cubic space of the cavity and the placental area are quickly reduced, and thus the placenta is often cast into the vagina, and sometimes into the bed.

The mechanism of the detachment and extrusion of the placenta is effected by two forces of the uterus, retractility and active contraction. As the child is extruded from the uterine cavity, the uterus springs back as it were upon itself, effecting a restitution of form and size by virtue of its elasticity or retractility. To this force is added the active contraction of the muscular coat.

The placenta itself is detached before the membranes. The mode in which the placenta is cast out of the uterus has lately been much discussed. It is often observed that when the placenta is withdrawn from the vagina, it is inverted, that is, the feetal surface comes first, and the membranes following cover the maternal surface. This is of course the reverse of the relations of placenta and membranes in utero. On the other hand, when no traction is made upon the cord, and the expulsion of the placenta is effected by the natural forces, it is frequently found that the maternal surface is external, whilst the membranes preserve their natural relations, covering the feetal surface and the cord.

Recent text-books give comparative figures of these two appearances, one that representing the 'inverted umbrella' dis-

position from Schultze, who adopts Baudelocque's description; the other representing the placenta and membranes preserving their normal relations, from Duncan. Duncan maintained that the inversion was produced by manual interference. This is undoubtedly true sometimes. But it is an error to assume that it is always true. We can affirm from the most minute observation that the uninterrupted natural process will often produce inversion of the placenta; and also that moderate traction on the cord, aided by compression of the uterus, will deliver a placenta edgewise, the membranes covering the fœtal surface.

Baudelocque's account is perfectly accurate. 'Sometimes,' he says, 'the disunion begins at the centre of the placenta, and sometimes at a point of its circumference, and different phenomena result. In the first case, the middle of the placenta being pushed forward forms a pouch which fills with blood, and which presents to the touch its surface covered with membranes and vessels. A similar pouch forms, and the placenta presents in the same manner, when it begins to separate by the farthest edge from the os uteri. But things take place differently when the placenta is detached from below, especially when near the os. In this case it rolls upon itself like a cylinder or horn, according to the length of the uterus, so that it presents by its rough aspect, and its exit is always preceded by a discharge of blood.' The case could not be better stated.

Tarnier affirms that the inversion of the ovum is habitually spontaneous, so that the amniotic aspect usually looks externally. The placenta, he says, first detaches itself, and in descending upon the neck of the uterus and into the vagina, it drags the membranes, which in their turn become detached; thus the ovum turns inside out like the finger of a glove, and presents its amniotic surface outwards. It is the fœtal surface then which usually presents itself at the orifice of the uterus, even when no traction is made upon the cord; but Tarnier also admits that the placenta sometimes presents by its edge. Ribemont-Dessaignes and Pinard, basing on numerous observations ad hoc, affirm that the placenta in the great majority of instances presents by its fœtal aspect. We conclude that both presentations may occur spontaneously; and we are prepared to go further and say, that the edge presentation, membranes covering the amniotic aspect,

may occur under traction upon the cord. At the same time it must be admitted that traction upon the cord when the insertion is central favours inversion. The explanation, we think, will be found in the seat of attachment of the placenta. When the placenta is implanted upon the fundus, or anywhere within the upper polar region, the cord is usually central as regards the placenta, and the central detachment described by Baudelocque, leading to bulging of the middle of the placenta, most frequently takes place (see fig. 3, p. 40). On the other hand, when the placenta has grown to the sides of the uterus, a part dipping within the lower zone or segment, this lower edge will generally be first detached and the placenta will descend edgewise, roll up lengthwise, and come into the vagina with the membranes covering the feetal aspect.

We offer this explanation not as a matter of speculation but as the result of many and careful observations upon the phenomena attending the various seats of implantation of the placenta. These observations will be again referred to when describing the history of Placenta Prævia. This view of the mode of presentation of the placenta depending upon the seat of implantation is described by Baudelocque. Figs. 3, 4 represent the ordinary mechanism of detachment and expulsion of the placenta when it had grown to the upper region of the uterus; and figs. 5, 6, when it had grown to the sides.

When the placenta is detached, the uterine contractions drive it into the vagina. If no interference be practised, this

stage takes about ten to twenty minutes.

The next stage consists in the expulsion from the genital canal. This may take an hour or more. The recently distended vagina is expanded by the intruding placenta. It lies there beyond the range of uterine power; the vagina itself possesses inadequate contractile force; and but for the forcing action of the voluntary muscles exerted as in defection, the placenta might remain for an indefinite time. Indeed, William Hunter and others of his school, carrying to extremes faith in the sufficiency of Nature to complete a physiological process, were in the habit of leaving the work to Nature. The results were in some cases so disastrous by hæmorrhage and septicæmia that this negative practice was abandoned.

There are four principal methods of managing the placenta.

The *first* is the exploded one just described of doing nothing; but sometimes there is nothing to do. The *second* is that of removing it by hand from the uterus or vagina. The *third* is by expression, or squeezing the placenta out of the uterus or vagina by hand-pressure applied to the uterus. This is called 'placental expression.' The *fourth* is by introduction of the hand into the uterus. These methods form an ascending scale,



FIG. 3.—Representing first stage of separation of placenta from fundal attachment, Commencing inversion of placenta, (Robert Barnes.)



Fig. 4.—Second stage of detachment of placenta from fundal attachment. Inversion complete, dragging membranes on maternal surface. (Robert Barnes.)

coming into successive use according to the rising necessity of the case.

If we are sure that the placenta is detached from the uterus, the second plan, which consists in simply withdrawing it by gentle traction upon the cord, aided by steady pressure on the fundus, is the best. How do we know that the placenta is detached? This may be inferred to have taken place if, after

a few minutes' rest, pains or contractions of the uterus are felt by the patient; if the obstetrist feel the uterus harden and become sensibly reduced in bulk, forming a firm globe reaching not much above the umbilicus. Sometimes he may feel the uterus undergo sudden and considerable reduction in bulk, and he is sensible that something has passed out of its eavity.

The next step is to pass the index, the cord serving as a clue to search for the placenta. If he fail to reach the root of

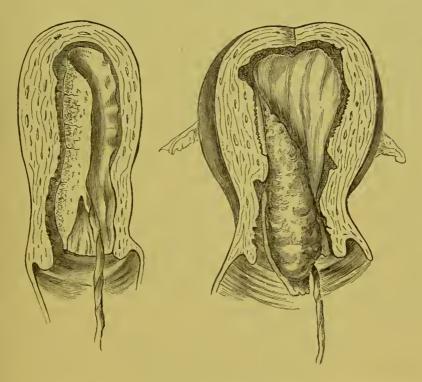


Fig. 5.—First stage of detachment of placenta from lateral attachment. Descent edgewise. (Robert Barnes.)

Fig. 6.—Second stage of detachment of placenta from lateral attachment, rolling-up lengthwise and descent edgewise; membranes following on feetal surface. (Robert Barnes.)

the cord and to feel the placenta, he may infer that the organ is not yet detached; if, on the other hand, the placenta be easily felt, it is because it is detached and has come down into the cervix or vagina.

Then eomes the question of removing it. A common error is too great haste to interfere. Wait a while for the uterus to recover power, and the placenta to mould itself to the passages.

If we begin traction too soon, the irritated nterus is thrown into spasmodic action, the natural order of its contraction is perverted; the placental seat, liable to a kind of paralysis, and the placenta, still perhaps partly adhering, is passive or only slightly contracting; more active contractions are provoked in the lower part of the uterus. The effect of this is to imprison the placenta in a pouch at the upper part of the uterus. It is 'incarcerated,' 'encysted,' or there is the so-called 'hourglass contraction.' And then, until the disordered action of the nterus has been calmed by repose, or a dose of opium, or a whiff of chloroform—a remedy to be avoided in this stage—the placenta will not come away, unless it be by the forcible introduction of the hand through the constricted part of the nterus —also a proceeding to be avoided if possible; or, if we proceed to remove the placenta whilst the uterus is still inert, we run great risk of causing inversion.

Proceed then gently, and after a proper interval of rest, before trying to remove the placenta.

Another imperative rule is not to give ergot during the placental stage. Ergot given at this time is likely to defeat the very object in view. It is likely to excite irregular spasmodic or tetanoid contractions, which will lock up the placenta, and render all attempts at manual extraction abortive, even dangerons.

How to remove the placenta.

- 1. During the last stage of the expulsion of the child, the nurse or other assistant will have been pressing steadily upon the fundus uteri, following the child down.
- 2. Keep np gentle pressure upon the nterus after the birth of the child. Avoid kneading or rubbing the nterus, unless it be done very gently; otherwise this manœuvre is apt to cause disordered spasmodic action, and we have suspected it to be the cause of metritis.
- 3. After a repose of three or four minutes, holding the cord by one hand, run a finger along it into the vagina. In this case two fingers may be firmly pressed near the root of the cord into the body of the placenta, so as to hook the placenta down towards the vulva. The pressure is steadily made backwards, following the curve of the sacrum. You thus get by the combined use of the two hands 'axis-traction.' At the

same time moderate traction is made on the cord, and the whole mass is made to slide down. By the eonsentaneous light traction on the cord, downward and backward pressure upon the placental mass, and steady pressure upon the fundus uteri by an assistant, the distributed force avoids unduc force in any one direction, and the placenta, if detached, is removed in the easiest and safest manner. Nurses will often at this point urge the patient to cough or bear down, and this may succeed. Harvey effected extrusion sometimes by giving a sternutatory. Pulling unduly upon the cord is apt to cause it to break away from the placenta. The most common seat of rupture is near the insertion. Hence we may infer that this is the weakest point. This accident entails the loss of the natural clue to the placenta, and renders it necessary to pass the hand into the vagina, or even into the uterus to seize the placenta, unless it can be squeezed out, as will be presently described.

4. As soon as the placenta is outside the vulva, seize it in both hands and rotate it two or three times, so as to throw the membranes into a twisted rope. This gives them more cohesion, and the risk of leaving shreds behind is lessened. Fig. 4 shows how the mass of the placenta protruding in vagina or near outlet favours this rotation by the hands, and serves to draw the membrane down rope-form.

5. The placenta removed, steady pressure is still kept up on the fundus uteri, and the expelled clots and liquor amnii are received into diapers, or, better still, into a shallow bowl. The bottom of the sponge-bowl answers well. This plan screes the double purpose of cleanliness and of enabling us to estimate the quantity and other characters of the discharge.

6. If the uterus is now felt contracted, firm 'like a cricket ball,' a broad binder may be applied. In the case of a primipara this may be enough, but in the case of a pluripara, in whom the abdominal walls are flabby and give little or no compressive force, a pad may be useful, so applied as to rest upon the fundus of the uterus, and be kept there by the binder.

When the placenta is expelled the uterus enters into permanent concentric contraction. The anterior wall of the body is compressed against the posterior wall, the fundus shrinks down upon the body; the lower segment also contracting, the

whole organ regains something of its shape before pregnancy. It now resembles a pear flattened a little antero-posteriorly. Its cavity is now again triangular; into the two upper angles the Fallopian tubes open; the lower angle corresponds with the cervix. Normally, the juxtaposition of the anterior and posterior walls is so close that the cavity is obliterated; but owing to the forcible stretching which the lower segment and the cervix have undergone, partly paralysing the muscular tissues, and tearing and bruising the cervix, especially at the os externum, this part remains flabby and open for a time; and not seldom that part of the uterus to which the placenta had grown is paralysed for a while.

The fourth method, by passing hand into uterus.

If the placenta is not readily expelled or removed by the method described, we have to discover the cause of the delay:—

1. The placenta may be wholly detached, and yet be retained in the uterus. Simple retention.—This may be due to want of contraction of the uterus. As has been already pointed out, for a few minutes the uterus, after the supreme effort of expelling the child, is exhausted; it wants repose to gather strength to expel the placenta. If the course of labour has been disordered, or if premature attempts are made to pull away the placenta, the uterus will contract irregularly; its polarity may be inverted, so that the lower segment contracting unduly, spasmodically, the placenta is shut up in the uterine cavity.

Hæmorrhage commonly attends this condition.

2. The placenta may not be detached. Maintaining adhesion, partly or entirely, we then have retention with adhesion. The adhesion may be natural or morbid. In the case of partial adhesion, hemorrhage is almost certain.

We must not hastily conclude that the placenta is adherent. Adhesion is the bugbear of students and young practitioners. Practically it is very rare. It is a good rule in the first place to act as if it were not adherent, or as if the adhesion were only partial and easily overcome by the methods commonly used to expel the placenta, reserving the extreme measure of introducing the hand for those cases in which the common methods fail.

Assuming then the case in which the plan described in

Section 3 fails, we may resort to 'squeezing-out' or 'expression.'

Although long practised in Dublin, and precisely described by McClintock and Hardy in 1848, and in London by ourselves, in ways varying in detail, the name of Credé has of late years been especially associated with this manœuvre.1 The proper way to squeeze out the placenta is to place the patient on her back near the right side of the bed. You thus obtain perfect command over the uterus; you can use both hands to assist and relieve each other, avoiding unsteadiness and fatigue. The uterus is grasped by a hand applied on either side of the uterus, the balls of the thumbs resting upon the fundus. Then acting with spontaneous uterine contraction if it set in, or without if the uterus is paralysed, concentric pressure is made by the hands. The uterus will tilt a little on one side, so that the anterior wall will be flattened upon the posterior the normal condition of the empty uterus. In this way, regular contraction of the uterine muscle is promoted; its due polarity is restored by making the fundal action preponderate over the cervical action; its cavity is reduced in all its diameters; the placenta is driven out into the vagina, and by continuing pressure it is even shot out of the vagina into the bed. We trace this process going on by feeling the shrinking of the uterus under our grasp. The escape of the placenta from the uterine cavity is announced by a sudden reduction in bulk, and the escape of the placenta from the vagina is also felt by the operating hands. The process also is distinctly traced by the patient. The operation causes some pain, but should not on that account be done under chloroform or ether. These agents certainly counteract healthy uterine contraction and promote hæmorrhage. The patient must exercise a little courage. The quick and effective relief compensates for her suffering.

Timely applied, 'expression' aids and is aided by natural contractile effort. In this lies security. Expression as sometimes practised, by applying excess of pressure to the fundus, pushing it in towards the cavity, has caused inversion. See a

¹ The whole question of the removal of the placenta in its historical and clinical connections is fully discussed by Ribemont-Dessaignes, Thèse de Concours, Paris, 1883.

case by Schnorr. Johnston and Sinclair also relate a case. A case of inversion which was admitted into St. George's (1881) under Robert Barnes' care was produced in this way. Again, by unduly pressing the uterus down into the pelvis, retroversion has been caused. Both these serious accidents are avoided by following the method described.

A great advantage attending the method by expression is that it obviates passing the hand into the uterus. Dohrn demonstrated that the method was followed by bad results when practised immediately or very soon after labour. Fifteen minutes or more should elapse before resorting to it.

The placenta refusing to be squeezed out, we may assume that it is retained either (1) by irregular contractions of the uterus, including the so-called 'hour-glass contraction,' and preponderant contraction of the lower segment of the uterus, or (2) by adhesion. The term 'hour-glass contraction' sometimes applicable, more often suggests a false picture. is rare indeed to observe a case in which there is an annular constriction of the middle zone of the uterus dividing it into two cavities, the upper one containing the placenta, the lower one relaxed and freely open to the vagina. The more common condition is that in which the placenta is shut up, 'encysted,' in a chamber formed near the fundus by a spasmodic contraction of all that part of the uterus which lies below the region of the placental site. This condition arises from a combination of two factors: (1) the muscular wall corresponding to the placental site is paralysed instead of being the centre of active contraction: (2) the lower part of the uterus, which ought to be comparatively inert and yielding, contracts unduly and spasmodically. There is reversed polarity. This condition is commonly brought about by pulling upon the cord, or by other treatment which disorders the proper sequence of the factors of labour. Hemorrhage often attends.

To meet this difficulty it is well in the first place to allay disordered nervous action by sedatives. Twenty or thirty drops of laudanum, with twenty of tincture of digitalis in camphor water, may be given. If the patient is unusually weak, it is better to inject sixty minims of pure ether under the skin, or make her breathe a few drops of nitrite of amyl. The patient

¹ Monatsschr. f. Geburtskunde, 1867. ² Practical Midnifery.

operator then grasping the fundus uteri in his right hand applied above the pubes, introduces his left hand into the vagina, and making his fingers into a cone-form passes them through the os uteri until he arrives at the constriction Then by steady sustained pressure, aided by downward pressure on the fundus, the resistance is overcome. This is not to be done by violence, but by sustained pressure, on the principle of tiring out the muscular spasm. The constriction passed, the fingers may be opened to grasp the placenta. Endeavour to begin with an edge, so as to glide the fingers between the placenta and uterus, detaching it if it adheres. Holding the



Fig. 7.—Representing manual removal of placenta. (Robert Barnes.) Left hand in uterus peeling placenta from its attachment. Right hand externally pressing fundus upon left hand.

placenta, by eonsentaneous drawing-out, and external eompression, the placenta is removed. In this proceeding the external compression should be the preponderating force. (See fig. 7.)

Being assured that the uterus is well emptied, compression should be still kept up on the uterus until it is thought

proper to apply pad and binder.

If the placental retention be due to adhesion, the proceeding just described is to be followed out. In most eases the adhesion is not due to abnormal tissue, and the separation is

easily and completely effected by pressing the fingers on between placenta and uterus. In some cases, however, the adhesion is so intimate that it is difficult to feel where placenta ends and uterus begins. In such a case it is easy to be overzealous. The safer rule, long ago pointed out by F. Ramsbotham, is to detach all that can be detached without violence, and by passing the tip of the finger into any projecting masses to break them up, to destroy their active vascular connection with the uterine wall. This done, the great immediate object of removing an active cause of hæmorrhage is accomplished, and you avoid the serious danger of wounding the uterus. After such an operation it is desirable to wash out the uterus with hot carbolised water in the proportion of 1 in 50.

We must be prepared to find pieces of placenta now and then coming away after this operation, and for the reproaches of attendants and gossips, ever ready to blame the doctor who 'left some of the after-birth behind.' These we must bear with equanimity, content if we have done our best to bring it away safely, not rupturing the uterus or setting up metritis, and taking care by appropriate after-treatment to obviate any ill consequence that may arise from the imperfect operation.

This after-treatment is important. (1) There is the washingout with carbolised water; (2) the administration of quinine
and ergot to keep up contraction of the uterus; (3) if hæmorrhage return soon, inject hot water, then solution of iodine,
and if that fail, perchloride of iron. If hæmorrhage should
recur after two or three days, anæsthetise the patient, and
pass the fingers into the uterus for another attempt to remove
the portions left adhering. They may now yield more readily
before the fingers. In some cases we have successfully employed the wire-écraseur, treating the projecting masses like
polypi. Indeed, they have been not inappropriately called
'placental polypi.' The wire is perfectly safe, it cannot dig
into the uterine substance; it simply shaves off the projecting
masses smoothly.

The placenta delivered, we come to the post-placental

period.

We have now to consider how to dispose the patient to make her comfortable and safe before leaving. The first point to determine is the application of a binder. To apply a binder properly, the patient must be laid upon her back, with the legs extended. In this position the operator has complete command over the uterus, and the binder embracing the hips well exercises uniform effective support, and is less likely to ride up and become loose.

Tyler-Smith says 1 'women have died suddenly for no other reason than that the binder was omitted.'

It is an excellent plan to apply a temporary binder during the second stage of labour, tightening it according to indications as the uterus and abdomen become smaller. This need in no way impede manipulation. The diffused support given to the abdominal walls is of material assistance. The pressure upon the uterus keeps the axis of uterus and child in due relation to the axis of the pelvis; it promotes steady contraction of the uterus; it maintains due tension of the abdominal vessels; it gives a sense of comfort and power to the woman; and it facilitates the adjustment of the permanent binder. This plan further obviates the principal objection made to the lateral or English decubitus of the parturient woman, namely, that it allows the uterus and abdomen to bag down away from the pelvis. It is especially useful in pluriparæ. In healthy primiparæ, and in many pluriparæ who preserve good nerve and muscle, the uterine contraction following expulsion of the placenta is steady and persistent, and there is little or no pain, except perhaps a sense of soreness and fatigue. But when the patient is of weak fibre, when the nervous system is unduly mobile, the uterus, after having contracted, may relax again; and there is a tendency to the recurrence of contractions, not in strict rhythm, but in a disorderly manner. These contractions are attended by pain- after-pains.' The explanation of the pain is found in the circumstance that the relaxing uterus favours an outpouring of blood into its cavity, which, clotting, excites reflex action; and the induced spasmodic contraction, not easily expelling the clots, causes pain. This condition is analogous to dysmenorrhæa from retention.

A second cause of after-pains is distension of the bladder. This organ will probably have been emptied during the labour, but not seldom it becomes temporarily paralysed, and filling,

irritation causing reflex spasmodic contractions is set up. This irritation may be propagated to the uterus.

A third cause, often unsuspected, is retroversion or retroflexion of the uterus. When bulky and flabby, the fundus easily falls back, or is thrust back under obstetric manœuvres, during and after the extrusion of the placenta. E. Martin, of Berlin, also showed that retroversion, post partum, was favoured by the placenta having grown to the posterior wall of the uterus. This part, thus rendered thicker and heavier, falls back. In like manner, attachment of the placenta to the anterior wall favours anteversion, and also 'after-pains.' The combined distortion and malposition impede the circulation through the uterus, lead to congestion and hæmorrhage, and the retention of clots in its cavity: hence 'after-pains.'

Before leaving the patient, observe the aspect of her face, feel the pulse, feel the abdomen, *look* at the vulva to see if there be any trickling of blood. If she complains of feeling faint, shows marks of undue depression, says she feels a discharge coming from her, and this is confirmed by examination; if the abdomen enlarges, undo the binder, pass the catheter, compress the nterus firmly by the hands to expel clots. The treatment now is that for hæmorrhage, which will be specially considered in another chapter.

Examine the placenta to see that it is entire, and to take note of any abnormal condition.

Tying the cord. When the child is born, the question of tying the cord arises. It has been contended that tying the cord is superfluous, and the practice of the lower animals has been cited in proof. It is true that when the child breathes the immediate effect is to turn the current of the circulation into new channels and to divert it from the placenta, and therefore from the umbilical cord. It is also true that when the cord is divided, without tying it, there is a spontaneous retraction of the umbilical arterics within the tissnes of the cord, and such a diminution of their calibre that bleeding will commonly be prevented. Ribemont-Dessaignes has carefully described this anatomical arrangement. P. Dubois, Depaul, and others made numerous observations to test the necessity for tying the cord. They found that in a great number of cases no bleeding followed simple division

Tarnier points out that in all these experiments the aërial respiration was well established before the cord was divided. And we may add that in cases where we have had occasion to cut the cord before applying a ligature, and before the child has breathed, bleeding has taken place; and in some cases in which the ligature was not tied tightly enough, bleeding has taken place some hours after the child had breathed freely. Similar facts must be known to every experienced obstetrist.

The appeal to comparative parturition is not free from fallacy. Animals lacerate the cord with their teeth, or stamp upon it, to effect separation. The effect of this is similar to that of torsion of arteries. To imitate this, it has been recommended to use blunt scissors. The idea is not without value. But it is safer to tie. It would not be pleasant for the obstetrist, nor conduce to his reputation, to be called back to the lying-in chamber to find the child bleeding to death.

Granting then full force to the anatomical and physiological provisions against hæmorrhage, no one at the present day would omit the precaution of tying the cord on the child's side of the point of division.

Since the cord must be tied, what is the right time for doing it? Some practitioners tie the cord immediately after the child is born, others wait till pulsation is no longer felt in the cord; others, again, wait until the child has fairly breathed.

The immediate ligature ought to be abandoned. There are physiological and clinical reasons for waiting until respiration is set up. Budin instituted experiments at the Paris Maternité, under the direction of Tarnier, to illustrate this point. When the cord is divided immediately, the quantity of blood poured out from the placental end is notably greater than when the division is made after the cord has ceased to pulsate. Now the question arises: What becomes of the excess of blood when the cord is tied at the later period? It passes into the circulation of the child. So Hélot and Schüking 's showed that when the cord was left untied,

¹ Zur Physiologie der Nachgeburtsperiode, &c., 1877.

adhering to the placenta still in utero, weighing the child immediately after birth and again after the cord had ceased to beat, they found the child had gained sensibly in weight.

Against immediate ligature there is the further argument that the placenta may still be in vascular relation with the uterus, and that the child depends upon this relation until it breathes.

Our own practice has been to wait until the child breathes, or at any rate until the cord ceases to pulsate. Usually when the child breathes, the pulsation in the cord stops. But occasionally the cord ceases to pulsate before the child breathes. In this case there is nothing to be gained by further delay. The animation of the child is more certainly achieved by removing it from the bed to practise the necessary manœuvre. The plan to adopt is this: When the child is born, turn it on its back; clear away discharges, membranes, and anything that may obstruct respiration, from its mouth and chest; let it lie in the bed until it breathes and cries freely. Observe the cord: at first turgid, purple, pulsating strongly, it gradually shrinks, becomes pale and flaccid, the pulsations become feeble or stop. The ligature may now be applied. One is enough. There is no good reason for applying a second ligature on the placental side.

How to tie the cord. At what point is it best to tie it? The usual practice is to tie at about two or three inches from the umbilicus. The best material is stout thread, doubled four or five times. It is better waxed, so as to make it bite more tightly. The ligature is passed in two circles round the cord, and then tied in a double knot very tightly, so as to bury the ligature in the Whartonian jelly. This is most surely effected by tightening the ligature slowly. Notwithstanding every care, the ligature will occasionally get loose from the shrinking of the mucous tissue of the cord. Hence the necessity for examining after an interval of half an hour or more.

Tarnier contrived a special plan to ensure obliteration of the vessels. He applied a match-stick parallel to the cord, then the ordinary ligature, and then an elastic ligature. Budin made experiments which proved that the elastic ligature is the most efficacious. Dr. Dickson had in 1876 made use of an clastic ligature. Sometimes the cord is torn off accidentally on a level with the umbilicus. In such cases we have passed a fine needle through the stump, and twisted a silk thread in a figure of eight round it. A similar proceeding may be required when bleeding follows the falling of the cord, as sometimes happens.

This done, the child is received in a flannel and given to the care of the nurse.

CHAPTER II.

THE PUERPERAL PROCESS, OR THE NATURAL HISTORY OF CHILDBED.

THE transition from gestation and labour to puerpery is marked by (1) sudden diversion of blood-flow from the pelvic vascular system. The current is turned back upon the general system; hence, according to Marey, temporary increase of vascular tension. This diversion is analogous to and coincident with the equally sudden diversion of the child's blood from the placenta on tying the cord.

- 2. The developmental force which hitherto attracted bloodflow to the pelvis is suddenly arrested.
- 3. This diversion of the blood-flow is effected by contraction of the uterus, at first active, then tonic, which, compressing the uterine vessels, bars them against the entry of blood into the arteries.
- 4. Changes are wrought in the system. Cessation of pain and nervous tension.
- 5. A vacuum is produced tending to pump in air, unless the abdominal walls are endowed with extraordinary vigour, muscular and elastic, to retract and obliterate the space left by the emptied uterus. This sudden loss of support or natural pressure upon the intestines, and through this upon the uterus, vena cava, abdominal aorta, and liver, further takes off the natural tension of the vessels, and disturbs the action of the heart, disposing to syncope and thrombosis.

This vacuum-action is proved by the observation during labour of the recession of the presenting head as the pain goes off; it is felt and measured by the forceps which previously adjusted, is drawn up into the pelvis between the pains. During craniotomy we may feel and hear air sucked into the

cranium during remission of expulsive action, and driven out when the expulsive action is renewed.

The mechanism that favours the in-draught of air also favours the entry of noxious fluids into the uterine sinuses.

Hence the necessity for the twofold and associated security obtained by supporting the abdominal walls and obtaining contraction of the uterus. This is the first point in antiseptic midwifery.

The uterus is stimulated to contract by pressure upon its fundus, as by the hand; and through the abdominal walls by a bandage.

The transition from the state of gestation to that of childbed, effected by labour, is attended by a great systemic revolution. The system is no longer dominated by the fœtus. A special condition of the system had been developed in order to carry out the process of gestation. That process completed—and it is completed abruptly—the special conditions of gestation abruptly cease, and a new régime is established. The gestation process also calls forth a special development of certain organs, raising them to a state of physiological hypertrophy. The purpose of this special development accomplished, these organs at once enter upon a process of so-called involution, or return to the ordinary condition of non-gravidity.

We have thus two orders of phenomena to observe—the general and the local.

A. The general phenomena. The most striking of these relate to the functions of innervation, of the circulation, of respiration, of nutrition, of secretion and excretion, and to the attendant changes in the organs which perform these functions.

B. The *local phenomena* relate to the functions of the generative organs and the changes effected in them.

The general and local phenomena must of necessity be described one by one; but it is essential to follow up this analytical study by a mental synthesis, bringing them all together in solidarity. They are physiologically links in a circular chain; all are interdependent. If the harmonious relation of these general and local functions and changes is disturbed, then the whole purperal process is disordered, and a physiological state merges into a quasi-pathological state.

The same forces will continue to act, complicated, perhaps, by the intrusion of foreign influences. The right appreciation of the diseases of the puerperal woman, then, must rest upon the foundation of accurate knowledge of the healthy purperal process. Here the definition of pathology started by Robert Barnes finds an appropriate illustration: 'Pathology is Physiology struggling under difficulties.'1

Among the general post-partum phenomena the most striking is the rapid fall in nervous and vascular tension. The process of structural building is suddenly arrested; the nervous energy accumulated for the tremendous act of labour is expended. A new order of things is established. Instead of building, demolition has to be effected. The hitherto constantly increasing increment of tissue and fluid elements is not only suddenly stopped, but the accumulated material has to be rapidly got rid of. The physiological energies are reversed. Active nutrition gives place to active absorption and excretion. Endosmosis predominates over exosmosis.

We may form an idea of the magnitude of the revolution that takes place at the moment of the completion of labour, and of the work that has to be subsequently done, by studying the facts stated by Gassner, showing the loss of weight undergone after labour.2

Admitting that these observations are nearly true, we may deduce some instructive applications.

- 1. The parturient woman almost suddenly loses about 10 per cent. in weight of the solids and fluids which up to the moment of delivery formed part of her organisation.
- 2. This tenth part being of about equal specific gravity with the rest of the organism, occupied proportionate space. And this cast-out tenth part was almost wholly contained in the abdominal cavity.

Within an hour then, or less, the body has lost one-tenth in weight and one-tenth in volume. A change so great and so rapid cannot fail to be attended by corresponding changes in the processes of nutrition, chemical and mechanical. The sudden separation of the child and placenta may be likened to an amputation at the hip-joint. Certainly there are wide differences in the subsequent conditions; but we shall have

¹ Lancet, Clinical Lectures. ² See vol. i., p. 220.

to refer presently to one or two points of great analogical interest.

The first effect is *shock*. An impression more or less profound is made upon the ganglionic, cerebral, and spinal centres. In most instances this shock is an entirely healthy phenomenon. A transient stage of depression, not amounting to exhaustion, is soon followed by a sense of relief, even of restored power, of happiness. In other cases the depression is more serious. The nerve-power is exhausted; it is not duly recruited; the heart flags or fails altogether; the spinal cord and the brain are partially paralysed. The blow may be so heavy that life may be extinguished. This is one of the causes of sudden death in childbirth. Between the beneficent physiological shock and the shock that kills, there are degrees varying with the severity of the labour and the power of the woman. These intermediate degrees of shock are marked by syncope, by hæmorrhage, or other more or less dangerous symptoms.

2. After shock comes reaction. After healthy shock the processes subsequent upon labour are carried out in safe and regular order. The reaction that ensues upon the severer intermediate degrees of shock is fitful and disorderly; the nervous influence is unequal to maintain the due control, to regulate uterine action and the work of the circulation. The physiological balance is disturbed, the blood-mass is almost surely affected in quantity and quality; the absorbent and secreting organs are therefore disturbed in their work.

Hence we often see after severe labours that the puerperal process is disordered. We trace back then to the labourshock many cases of puerperal disease.

We may first take note of the more purely mechanical influences. When tracing the history of gestation we cited the description of De Cristoforis of the mechanical disturbances induced by the gravid uterus. He contends that the uterus pressing upon the abdominal aorta and iliac veins and inferior vena cava causes (1) superior arterial hyperæmia, with increased heart-tension and hypertrophy; (2) inferior venous hyperæmia. Now, the sudden diminution in bulk of the uterus is followed by the liberation of the abdominal

¹ See vol. i., p. 209.

vessels from obstruction. There will be an instantaneous tendency of the superior arterial hyperæmia to subside, the supply of arterial blood to the head will be lessened, the venous blood and serum arrested in the lower extremities will flow unimpeded towards the abdomen. Hence two dangers: syncope, due to the sudden diminution of blood in the brain, and the perturbation of the heart under shock; and hæmorrhage from the uterus, due to the free rush of blood to the vacated region of the abdomen and the lowering of tone under the shock. The normal counteracting or compensating provision against these dangers is mainly the firm contraction of the uterus. If this prevail, the circulation is quickly restored to its equilibrium and adapted to the new régime. The heart-tension is maintained.

Concurrently with these mechanical factors another factor exerts a powerful influence upon the circulation.

From the moment that the placenta is cast, the developmental energy, which had hitherto irresistibly attracted large volumes of blood to the utcrus, ceasing, the blood-current is turned off. This is the negative factor. The positive factor is seen in the contraction of the uterus, whose interlacing fibres constrict the blood-vessels and refuse admittance to the blood. The blood is called elsewhere. A new focus of developmental energy is set up in the breasts, and the vessels supplying these organs undergo a physiological hypertrophy. The breasts have superseded the uterus; the child has shifted the source whence it draws its sustenance. But the full establishment of the activity of the new developmental focus is rarely effected until the third day. To this first or mechanical process succeeds

The Involution-process.

This may be defined as the process by which the uterus and other organs are reduced or brought back to the ordinary condition of non-gravidity. Regression, then, would be the more correct term.

But preceding the removal of the superfluous solid tissue, there takes place a rapid absorption and removal of serum which has been exuded into the connective tissue of the lower limbs especially and of the pelvis. The ædema of the legs had mainly arisen during pregnancy; the ædema of the pelvis had been partly formed during pregnancy, but a larger part was the direct effect of labour. The lining membrane of the parturient canal had been partially detached from the subjacent tissues under the influence of friction by the advancing head. Hence extravasation not only of serum, but commonly of blood also. As soon as the pressure of the gravid uterus upon the pelvic veins, and the developmental turgor are taken off, the fluids in the connective tissue are quickly removed. The rapid entry of these fluids into the circulation probably helps to keep up vascular tension.

Then succeeds the true involution-process. The new tissue which had been formed in the uterus, heart, bloodvessels, liver, spleen, and probably in the nervous system, to subserve the nutrition and development of the fœtus and its extrusion, now superfluous, have to be got rid of. The process by which this superfluous material is thrown out of the system consists of several parts: the first is the conversion of the solid tissue into a fluid which can be taken up by the lymphatics and venules. This conversion consists in fatty metamorphosis. Being a strictly physiological change, the term 'degeneration' commonly applied is incorrect. The change has been most accurately studied in the uterine muscular tissue; but that the same change is undergone by the waste tissues elsewhere cannot be doubted. The liquefied tissues form what Virchow happily called 'physiological milk.' In this state they are fit for absorption. This is effected in the case of the utcrus by the lymphatic vessels and venules of the pelvic region. That part of the fluid which is taken up by the lymphatics undergoes the influence of the lymphatic glands; that part which is taken up by the venules undergoes the influence of the liver especially, before entering the circulation. Carried to the heart and thence to the lungs, further changes are effected. Some of its elements are there eliminated; and to this aërial elimination is partly due the peculiar smell to which the term 'gravis odor puerperii' is given. Carried on into the systemic circulation it is brought to the great glandular excreting system. The chief component parts of this system are the kidneys, the glands of the intestines, and the skin. The liver and the lungs, which came primarily into action, come in also secondarily with the other glandular organs. All work in solidarity. The process of involution, and therefore of absorption and excretion, is not actively established before the second or third day after labour. The granular metamorphosis of the new tissue necessarily takes some time. During the first two or three days the vascular tension is still high; and it may be stated as a physiological law that so long as high tension prevails absorption is slow. It is interesting to observe that the starting of involution and absorption is nearly coincident with the starting of the secretion of milk; and also that the first milk secreted during the early period of absorption differs in quality from that which is secreted later, when the ordinary equilibrium of nutrition is restored. The breasts then may be looked upon not simply as organs constructed to supply nourishment to the infant, but also as

special organs of excretion, helping involution.

How long does the involution process go on? The involution of the uterus is in great part effected within seven or eight days; but it may be broadly stated that the process is rarcly completed in less than a month. The course of involution admits of fairly precise observation. The uterus may be measured day by day by the sound. By measurements thus taken Robert Barnes has found the uterus from os externum to interior of fundus to be nearly three inches at the end of a week, and at the end of the fourth week to be barely more than 2½ inches, the ordinary length of the non-pregnant uterus. Looking to the uterus, the organ of prime importance, and which lends itself most freely to precise observation, it may be stated approximately that the uterus has to be reduced from two pounds, its weight immediately after labour, to two ounces, or a little more, its ordinary weight in the non-pregnant state. It must be remembered that the uterus which has been once developed under the influence of gestation rarely returns to the weight or size it possessed before impregnation. The sound may indicate in both cases a length of 21 inches, but the cavity only is thus measured, and the sound alone takes no measure of the thickness of the walls. The walls retain a certain degree of hypertrophy. The fundus between the origins of the tubes is now convex instead of flat. This increased thickness of convexity may generally be felt by the

hand applied above the pubes whilst the uterus is supported on the sound.

Tarnier estimates that the weight of the uterus after the placenta is cast out varies from 900 to 1,500 grammes.

Spiegelberg states the average weight to be about two pounds, and that two days after labour it is only one pound and three quarters; after the first week it is reduced to one pound; after six weeks or two months it is only 40 to 60 grammes, that is the weight of the non-gravid uterus.

Hecker has made some analogous observations. Conclusions drawn from weighings of the uterus are open to the obvious objection that a process which requires health for its performance can hardly be judged by observations made upon uteri in which that process had been disordered by fatal disease. Measurements by the sound in living healthy women are more trustworthy. Following this method, Robert Barnes has arrived at the conclusion that the regression of the uterus is more rapid than that indicated by the balance.

Dr. Sinclair, of Boston, gives tables of measurements made in puerpery. He found that in some cases the uterine cavity measured 2.50 in. or less in from 14 to 21 days. In one series of observations the cavity measured on the 16th day 3.50 in., and in a second series on the 20th day 3.80 in. In these two series there had been laceration of the cervix. It may be concluded that this has a retarding influence.

Dr. Milsom, at the Lyon Hospital, measured a large number of uteri from the day of delivery. Twelve hours after labour the uterus was 13.50 cm. above the pubic plane, on the 11th day it had fallen to 5.50 cm. above this plane. On the 4th day the uterine eavity measured 14 cm., on the 11th day 10 cm. During the first three days the diminution is more rapid than at a later period. Involution is slower in the cervix than in the body of the uterus. He says involution is retarded by suckling. It is a little quicker in multiparæ than in primiparæ. It is more pronounced in women who have not suckled.

The measurements found by ourselves are less than those of French and German observers. Accepting the data of these observers we should conclude that involution takes five or six weeks or more for completion. But it must be noted that

¹ Gynæcological Transactions, 1882.

their observations are all, or nearly all, taken in lying-in hospitals. Influences prevailing in these institutions retard the involution-process; conclusions drawn from this source cannot safely be applied to the healthy puerpera delivered under sound hygienic conditions.¹

We think it right to protest, in the interest of the women, against indiscriminate resort to uterine measurement in childbed. It can hardly be practised without some risk of disturbance of mind and body at a time when rest is above all things needed. We know that it is followed at times by high temperature; it is apt to favour the entrance of air into the vagina and uterus; and thus, and in other ways, to increase the risks of septicæmia.

The process of involution or regression. 1. We may first examine the extra-placental surface. After labour this is generally covered with clots. When these are removed, the internal surface is seen red, rough, jagged. Colin calls attention to small yellowish spots resembling the caduca which was cast off with the chorion to which it adhered. These are simply the remains of the caduca adhering to the muscular coat. From their surface little shreds project by their free ends into the uterine cavity. At the lower part of the uterine cavity the mucous membrane terminates by a well-marked jagged border which marks distinctly the line of separation from the old mucous membrane of the cervix which remains adherent to the muscular coat. Shreds of the mucous membrane of the cavity of the body are also seen floating in the cervix.

On scratching the surface of the cavity of the body of the uterus, a layer 1 mm. or 2 mm. thick, thicker as we approach the middle and fundus of the uterus, is detached. This layer is reddish-grey, friable, torn like a pseudo-membrane of recent formation. It is very vascular. Beneath it is the muscular coat, white or greyish, easily distinguished by its clearer colour, its fibrillar texture, and its greater firmness.

The portion of the parietal decidua which remains adherent is composed of inter-glandular tissue, and remains of glands, especially numerous in the neighbourhood of the muscular coat.

The blood-vessels, the lymphatic vessels, and spaces of the ¹ See Tarnier, p. 766.

inter-glandular tissue are widely open, and communicate with the uterine cavity. These vascular reservoirs form a kind of open gates through which absorption of septic matters may enter.

These structures undergo fatty degeneration and expulsion; then there is a process of regeneration of a new mucous membrane.

2. The placental surface. This presents a prominent, rounded, uneven, lobular mass, standing out from the surrounding surface. The internal surface shows the trace of separation from the placenta; it is called the placental wound. Robin says it is formed by the utero-placental mucous membrane remaining adherent, all but the thin superficial layer which had been torn away by the placenta.

The retraction of the uterus taking place after labour greatly reduces the extent of the bulging area formed by the serotina. Circular during pregnancy, it becomes oval, its long diameter being in the longitudinal direction of the uterus. But it gains in thickness. Some days after labour, the surface becomes folded, rough, as if lobular. Its tissue is brownish-red; it softens by degrees, becoming pulpy. The irregular, jutting edges are continuous with the mucous membrane which covers the rest of the uterus. It undergoes a similar process of regression to that which takes place in the decidua elsewhere.

Venous thromboses form at the level of the serotina; that is, clots are formed in the vessels of the serotina and in those of the muscular wall. On the surface of the placental site we may often see the mouths of vessels blocked by red or pale clots. If these clots are followed up into the thickness of the mucous membrane, we soon come to the subjacent uterine sinuses. We are struck by the cavernous aspect which the anastomoses give to this layer; and we may note that the prominences made on the uterine surface are due principally to the blood-clots which fill and distend the sinuses.

The thrombi which result from the slowing and finally the stagnation of the blood in the veins of the mucous and muscular coats in consequence of the regression of the uterus are not all produced at the same time. Thus at the seventh day after labour, we may find permeable vessels, not altered, without

trace of thrombus, by the side of other vessels obliterated either by recent thrombi, or by thrombi five or six weeks old, and therefore dating from a month or more before labour.

Friedländer and Leopold have described a spontaneous venous thrombosis as produced during the latter stage of gestation. The veins of the muscular coat and of the serotina are the seat of this thrombosis. The giant-cells of the serotina exist in groups and tracks, the length of the venous channels. At the end of gestation, from the eighth month, especially at term, these cellules are seen to penetrate into the walls of the sinuses, to part their endothelial elements, and thus to project into the calibre of the vessels, where they cause coagulation of the blood. Thus, a part of the venous sinuses corresponding to the placenta are already at term blocked by the giant-cells of the serotina, coagulum, and young connective tissue, so that the circulation in the veins is impeded. As we have seen, it is this process that Leopold assigns as the cause of the commencement of labour.

Thus, according to Leopold, the uterine mucous membrane is regenerated at the end of six weeks. At this time it is pierced on its surface by numerous small points representing the orifices of glands, and a superficial capillary network which plays an important part in menstruation. The placental site may remain raised above the general surface for a considerable time after labour. It thus constitutes important evidence of past pregnancy. The obliterated vessels disappear by fatty metamorphosis, sharing in the process of involution which seizes upon the muscular coat.

The state of the neck of the uterus after labour. During labour, and especially during the expulsion of the head, the neck of the uterus is exposed to enormous, even violent, distension. A process occurs to which in our opinion sufficient attention has not been drawn. The friction produced by the on-driven head naturally tells most upon the structures with which it is in immediate contact; this is the mucous membrane and the immediately subjacent tissues. At the same time the external wall of the lower segment of the uterus and cervix is partly supported, held back by the adnexa, that is, by the broad ligaments, the base of the bladder, the reflexion of the vagina, and the pelvic fasciæ. The consequence is that

the mucous membrane or tissues more immediately in contact with the head are carried down by a glacier-like action over the subjacent tissues. This movement is more marked on the anterior lip. Hence these phenomena ensue: (1) bruising, contusion of the superficial layers of the mucous membrane; (2) disruption of the smaller vessels running in the deeper layers of the mucous membrane and the superficial layers of the muscular coat; (3) hence, submucous hæmorrhage; (4) the whole cervix carried down is attended by great stretching, elongation, even laceration, of the connective tissue in the neighbouring parts of the broad ligaments, and in that immediately surrounding the cervix uteri; the consequence of this is some amount of hæmorrhage, always ædema.

In addition to this injury from contusion, there is almost invariably laceration of the edge of the os externum. This laceration most commonly takes place in the left side of the os, that is, on the side which had to encounter the violent impulse of the broad firm occiput of the fætal head. This remains after childbed; it hardly ever heals completely; it is partly restored by cicatrix; but not uncommonly the os externum remains fissured down to the angle of vaginal reflexion.

The proof of the violence done to the mucous tract of the cervix is seen in the black ecchymosed condition of the cervix and os in women who have died soon after labour. This appearance we have never known absent. Several museums contain characteristic specimens. The proof of the sliding down of the lower segment and cervix is seen in the ædema in the perimetric connective tissue. This traumatic process may be the starting point of perimetritis and puerperal fever.

The crushed mucous membrane, or at least the epithelial layer falling into necrosis, is almost necessarily shed during the

process of repair.

After labour the os externum is flabby, soft, sometimes difficult to trace; it offers no obstacle to the introduction of one, two, or even three fingers; but commonly obstruction is met at the os internum, a structure which yields more readily under distension without tearing than does the os externum, and which is moreover surrounded by more active contractile muscular fibres.

The length of the neck after labour. This point has been investigated by Breisky, Florinsky, Lott, and others. Lott¹ found the mean length of the cervix from the edge of the os internum to the os externum to be 7 centimètres after labour. The cervix therefore is elongated. The anterior lip is longest. Where the length is much less than 7 centimètres, it is generally in multiparæ and in cases of placenta prævia. The neck gradually shortens in the succeeding days, so as to measure on the twelfth day about 3 centimètres. On the twelfth day the neck has nearly regained its ordinary length, but the body of the uterus, still twice its proper size, goes on diminishing.

Whilst lessening in length the neck increases in thickness, and its orifices contract. The os internum may, according to our own observation, have recovered its ordinary calibre at least nearly, in two months; but the os externum rarely does so. We have, however, met with exceptional cases, in which the os externum had returned to the condition of a small round perfectly smooth aperture, exactly resembling that which is so commonly associated with sterility, so that it would be unsafe to pronounce an affirmative either of gestation or sterility from the condition of the os externum.

The lining membrane of the cervix no longer presents the longitudinal folds nor the circular folds; the oblique folds of the arbor vitæ which had been obliterated by the distension undergone during labour become visible again.

The broad ligaments, tubes, and round ligaments gradually recover their ordinary characters. The serous fluid effused in the connective tissue is rapidly removed under the energetic absorption process which sets in on the third day after labour.

The hypertrophied tissue of the heart, like that of the uterus, it can hardly be doubted, is got rid of by a similar process. But precise observation is more difficult. Robert Barnes, however, has seen the heart some days after labour in the state of fatty metamorphosis. The cases, it is true; have chiefly been those of women somewhat advanced in years, and in whom it may be supposed that the change was morbid, or true fatty degeneration. This objection may be valid. Further observations are desirable.

¹ Verhalten des Cervix Uteri während des Wochenbetts, 1872.

The conditions that favour involution are:-

1. A healthy organisation. The aphorism that 'Pregnancy is the great test of a sound body' is especially proved here. It is of prime necessity that the secreting and excreting organs be sound and in good working condition.

2. The due establishment and maintenance of lactation. We have seen reason to conclude that the breasts are ancillary, if not necessary parts of the great excretory system. Further, the diastaltic function is healthily stimulated by the due exercise of this function. The uterus is thus stimulated to contract.

Involution is more rapid in women who are delivered at term than in those delivered prematurely.

There is a divergence of opinion as to the rate of involution in primiparæ and in multiparæ. French authors generally affirm (Tarnier) that involution is more rapid in primiparæ. Schræder and Scanzoni think the reverse. Serdukoff holds a third opinion, namely, that in young pluriparæ, having had one or two children, involution is quicker than in primiparæ and in elderly pluriparæ who have had many children.

The influence of lactation in promoting involution is contested. Depaul, Charpentier, and, quite recently, Milsom, maintain that lactation retards involution, whilst Pinard maintains that lactation quickens it.

Gassner has shown that the diminution of body-weight is less in non-suckling women than in those who suckle. Hence the conclusion seems justified that the general process of involution and absorption after labour is promoted by suckling; and the presumption is strong that the uterus is affected in like manner.

The healthy exercise of the emotional and psychical faculties, arising from the satisfaction of maternal duty, is extended from the brain to the other nervous centres which are more immediately concerned in the regulation of nutrition.

3. That the hygienic conditions and other surroundings be good. Pure air, cleanliness, and good food are essential.

The conditions that impede involution. These are naturally the opposite of those which favour involution.

Inability to suckle may be taken as evidence of the

defective health-condition of the subject. Where the system or the breasts are unequal to the performance of this function, not only is one natural stimulus to involution and excretion wanting, but it may be expected that other organs are also unequal to their duty. In the other case of deliberate abandonment of this duty, similar evils will result, and it is unreasonable to expect immunity. Many of the cases of uterine disease associated with sub-involution may be traced to the neglect of lactation.

Another special cause is seen in retroversion and prolapsus of the uterus, a condition not uncommon after labour. The strangulation of the vessels supplying the uterus maintains a state of hyperæmia, a consequence of which is serous effusion into the uterine tissue. Where this displacement occurs, involution is almost surely retarded.

Metritis, perimetritis, pelvic cellulitis, any fever, all retard involution and also retard exerction, perverting or checking glandular action.

Return of the uterus to its primitive situation. Wieland states that, concurrently with its diminution in volume, the uterus tends during the first twelve days to resume its position in the median line, quitting the obliquity to the right or left which it maintains during gestation. During the latter period of childbed, the laxity of the ligaments and the mobility of the organ permit it to sink into the pelvic cavity. But as the ligaments, and especially the vagina and perinæal floor, recover tone, the uterus rises to its normal level.

Changes of consistency. In healthy conditions, the uterus immediately after labour feels, to use an English illustration, 'as hard as a cricket-ball,' especially if ergot have been given. Then it relaxes at intervals, rhythmic action still prevailing. During the succeeding days the uterus is softer, but still contracted. On the third day and the fourth it is like elastic or fibrous tissue. According to Wieland, at this time, which corresponds to the mammary flux, the uterus is softer. Further on, these alternations of hardness and softness disappear, and the uterus regains nearly the firmness it had before pregnancy.

It is necessary to bear in mind that when the uterus fails to contract, its tissues, especially in elderly multiparæ, may be

so soft that the sound or the finger may, if used roughly, easily penetrate, and even perforate the wall.

Changes of shape. After delivery, the uterus becomes globular, a little ovoid. The sides and the fundus remain more arched, and never quite regain the straightness of the multiparous uterus.

The lochia. Definition. By this term is understood the discharges which take place from the genital canal after the completion of labour, during the period of involution. This concurrence in time of the lochia with involution and excretion associates these acts as parts of the same physiological process. We accordingly find that when the lochia are abruptly suspended, the involution process is disturbed.

From the definition of the lochia above given must be excepted (1) the first or immediate discharge of blood, the 'physiological hæmorrhage;' (2) secondary or recurrent hæmorrhages; and (3) certain vitiated discharges.

When the uterus contracts in casting and expelling the placenta, the superfluous blood in the arteries and sinuses is squeezed out; part is driven back into the general circulation, part is shed on the free internal surface of the uterus. The blood so shed is the 'physiological hæmorrhage.' To this primary bleeding succeed 'the lochia.' During the first few hours the discharge is sanguinolent, then it becomes serosanguinolent, and this character is maintained for a variable time, extending to eight or ten days. These are called 'the red discharges' or the 'red waters.' They are composed of a sero-sanguinolent liquid, and usually contain minute, sometimes large, clots. Commonly, after six days, the lochia are no longer red; the discharge then is chiefly serous of a yellowish turbid green, the 'green waters.' Then they become whiter, purulent or puriform. This character continues for ten or fifteen days; in some women this discharge continues until menstruation is re-established. But in this case it may properly be said to have merged into leucorrhœa, and indicates imperfect involution or endocatarrh.

The quantity of the lochial discharge is variable within physiological limits. Gassner estimated that the discharge during the first three days amounted to 2 lbs., the loss during the fourth and fifth days 280 grammes, from the sixth to the

eighth day 205 grammes. So that during the week following labour the puerpera would lose by lochial discharges about 3 lbs. In practice, a rough estimate is made by counting the number of napkins used.

The lochia do not always present uniformity in order, in appearance, and quantity. For example, when the milk secretion is forming, the lochia are sometimes diminished or suppressed, and resume their ordinary course when the milk secretion is fairly established.

Accidental disturbances of the nervous system disturb the even course of the lochia. Emotions notoriously do this, sometimes checking the flow, but more commonly exciting hæmorrhage. Very sensitive women often lose blood whenever, in the early days of lactation, the child is put to the breast. It seems as if emotion, or pain, or reflex irritation suspended the inhibitory functions of the nerves which govern the circulation.

It has been said that the lochia are more abundant in women who do not suckle, and more abundant in pluriparæ than in primiparæ.

It has been said that in some women the lochia have been altogether wanting. This requires proof. Caseaux, however, relates an instance. On the other hand, Robert Barnes has described ¹ the persistence of an immoderate flow of nearly limpid fluid for some weeks after labour—a form of hydrorrhæa. This, he conjectured, came chiefly from the glands of the neck of the uterus, like one form of the hydrorrhæa gravidarum.

The lochia give out a peculiar odour. To this is commonly attributed the 'gravis odor puerperii.' But we believe the odour is also exhaled in some women by the skin and by the lungs. The odour thus exhaled may be taken as evidence of the absorption of lochial discharge into the system. In such cases we have noted a sallow aspect and a degree of febrility. We have taken this as an indication for syringing the uterine cavity with a weak tepid solution of carbolic acid or bichloride of mercury.

The following description of the microscopical and chemical character of the lochia is condensed from Tarnier and Chantreuil.

¹ Gynæcological Transactions, American, vol. i., 1876.

Microscopical characters of the lochia. Ch. Robin has shown that the blood which flows from the uterus after labour in most women contains leucocytes in the proportion of 1 to 5 in 100. A similar proportion is observed in the lochia during the first day. But it is not possible to determine whether these white globules come solely from the blood, or if, as is probable, a certain number are already produced on the inner surface of the uterus. After the first day, the lochia contain only about one-third of red globules, and two-thirds of other elements in suspension in the sero-mucous fluid. These other elements are white globules or leucocytes in slightly less quantity only than the red globules; they are isolated or agglutinated together, forming masses of variable size. There are also epithelial cells from the neck of the uterus of the pavement type or caliciform, according to the region from which they came. Wertheimer 1 found corpuscles of the embryonic connective tissue or in course of formation. These elements are simply the débris of the caduca which had remained adherent at the casting of the placenta. He also found crystals of cholesterine.

The viscid liquid which holds these elements in suspension is studded with numerous greyish molecular granulations and a certain number of small fatty granules.

From the second day, whilst the red globules diminish, the leucocytes increase in number. Soon they outnumber the red globules, and the lochia become gradually reddish or reddishgrey, and then greyish, or yellowish-white, or greenish. After the fifth, red globules are very scanty. The leucocytes become the predominant element; some have become voluminous, full of granules, and form what are called 'granular globules.' Along with these elements are found pavement-cells of the vaginal epithelium, often imbricated, in lamellæ, to which the other elements are adhering. Some polyhedric, or nearly spheroidal cells, similar to those of the deep layers of the vaginal epithelium or of the neck of the uterus, are also found.

vaginal epithelium or of the neck of the uterus, are also found.

Towards the end of the lochial flow the leucocytes, which had undergone fatty change, and the fatty granules, have diminished in quantity. The lochia may still contain from the beginning protozoa, as the Trichomonas vaginalis of Donné,

¹ Archiv für pathol. Anat. u. Physiol. &c. Bd. 21.

and the common bacteria observed by Haussmann and Hugh Miller.

According to Doléris, whose observations were made in the laboratory of Pasteur, there are almost always found in the purulent lochia the double micrococcus. This may be met with in healthy women; but in them it is rare. It is only when it multiplies that it becomes dangerous. On the other hand, it is only in sick women that the micrococcus en chapelet is found. This is the microbe which Pasteur is disposed to regard as the microbe of puerperal fever. All these microbes pullulate in alkaline media; acid solutions, and especially phenic solutions of 1 in 50, kill them. Eustache (1884) found the microorganisms under normal as well as pathological states.

Chemical composition of the lochia. During the first days after labour, the reaction is alkaline; after the eighth day it becomes neutral or acid. At the beginning albumen is found; later, mucin, saponified fat, chlorides, alkaline phosphates, or phosphates of lime and iron, are found.

Modifications of the Principal Functions during Puerpery.

If the labour have been easy and not protracted, the woman experiences a sense of ease; the skin is fresh, there is no rise of temperature; the pulse is normal or even slowed. After difficult and prolonged labour, exhaustion is more or less marked. The face is suffused, the eyes sometimes injected, the skin hot, the pulse frequent; sometimes the patient sinks into deep sleep, others remain excited and restless. Some women experience a rigor or shivering immediately after the delivery of the child or placenta. This phenomenon is entirely reflex, and indicates nothing of serious import. Stoicesco has studied this subject by thermosphygmic tracings taken at the moment of the shivering, and affirms that it is never attended by rise of temperature or of pulse. This completely differentiates it from the rigors of pathological significance.

Three things call for specially careful observation during puerpery: the pulse, the respiration, and the temperature. As a general rule the pulse and temperature rise or fall together, and when both rise the respiration is almost invariably affected as well. The respirations increase in frequency and

¹ Thèse Inaugurale, Paris, 1876, and Tarnier.

become shorter. So long as we note normal conditions and relations of these phenomena we may feel confident that the puerperal process is pursuing the desired physiological course; and when, on the other hand, we detect any marked or continued departure from these normal conditions and relations, we must be prepared for pathological complications.

1. The pulse. In adult women the pulse usually beats 75 to 80 times in the minute; that is, it rises a little during gestation and labour. Immediately after labour the pulse often falls to 60 or 55, sometimes to less; but generally this slowing is soon followed by quickening, which lasts several hours. After this transient quickening the pulse often slows again. This slowing was first described by Blot. The extreme limit observed by Blot was 35. We ourselves, in a perfectly healthy woman, whose pulse before labour was 75, recorded 40 on the second day. Two figures struck Blot as specially common, namely, 44 and 56. This slowing may last from one to twelve days. Generally it lasts longer in pluriparæ than in primiparæ. There are individual differences in the time of its setting in. Most frequently it sets in twenty-four hours after labour. During the succeeding twenty-four hours it is more marked, and then gradually it disappears, and is followed by the ordinary pulse.

Sometimes the slowing ceases entirely when the breasts undergo the hyperæmia which precedes the secretion of milk; but more commonly the slowing is a little diminished.

The slowing of the pulse is observed after abortion and after premature labour, spontaneously or artificially induced.

When this slowing of the pulse is observed in a recently delivered woman, we may be assured that she is in a perfectly healthy condition. It is, therefore, a sign that justifies a favourable prognosis. Tarnier says, in a lying-in hospital the prevalence of slow pulses may be taken to indicate good sanitary conditions; the contrary condition indicates some noxious influences that challenge prompt and searching inquiry. The accuracy of these conclusions is amply proved by the experience of Fancourt Barnes in two lying-in hospitals.

ence of Fancourt Barnes in two lying-in hospitals.

What is the cause of the pulse slowing? The sphygmographic observations of Blot and Marey establish that this

¹ Archives Générales de Médecine.

slowing stands in relation to a certain degree of increase of arterial tension, and these authors believe that this tension is explained by the almost sudden arrest of the circulation which had been going on in the uterus during gestation. The blood then, which hitherto had traversed the uterus, is turned into the arterial system of the greater circulation, whence results a greater tension, causing obstruction to the ventricular systole, and slowing of the pulse. Later on the equilibrium is restored. This theory is supported by the fact that when hæmorrhage occurs the tension is lessened, and the pulse is accelerated. We should attribute greater influence to the hypertrophy of the heart which attends gestation.

Many observers have re-examined and criticised the statements of Blot. Generally they have been confirmed. Close observation, during many years, convinces us of their accuracy.

Hémey ¹ further showed that in a certain number of women recently delivered the pulse was subject to irregularity in force and frequency. These alterations in rhythm attended the slowing of the pulse. They commonly disappear in a few days. Since the publication of Hémey's thesis, Robert Barnes has studied this question, and is able to confirm Hémey's statements. He examined the heart without finding anything abnormal in this organ.

The slowing and irregularity of the pulse after labour should be carefully studied in association with the course of the involution process.

Modifications of the Blood after Labour.

We have seen that during pregnancy the fibrine, water, and white globules are increased in proportion, whilst the red globules are diminished. These conditions are continued in increased degree after labour. Andral and Gavarret, Becquerel and Rodier, and, more recently, Laurent established these facts. The researches of Malassez, of Bouchat and Dubrisay, of Fouassier have proved in the clearest manner the increase of white globules; and Peter has called this increase physiological leucocytosis. It attains its maximum about twelve hours after labour.

¹ Archives Générales de Médecine.

Further investigations, chemical and microscopical, into the constitution of the blood in pregnancy and childbed are greatly to be desired; they could hardly fail to throw useful light upon many interesting problems in physiology and pathology.

Cardiac Murmurs in the Puerperal State.

Dr. Money has made interesting observations in the General Lying-in Hospital.¹ He concludes that systolic murmurs occur in 75 per cent. over the præcordia of lying-in women. These murmurs are of three sorts: (1) The 'Endocardial-like' murmur is conducted to a variable extent; may be heard over any part of the area of the præcordia; (2) is 'friction-like,' and non-conducted, of very constant site, just above and to left of xiphoid cartilage; (3) is very loud, of curious quality, very capricious, and non-conducted. The most numerous of the first sort are loudest over the right ventricle, close to the edge of the sternum. They are not the expression of serious mischief; they are 'functional murmurs.'

We believe them to be simply hæmic, due to altered character of the blood and the state of the heart, which must change as the uterus does in tissue.

Modifications of Respiration.

Inseparably linked with the condition of the blood and circulation are the movements of respiration. Healthy women after labour breathe 15 to 18 times a minute, rather less frequently than during gestation. Dohrn spent great pains in investigating the relative capacities of the chest in non-pregnant, pregnant, and puerperal women. In 60 per cent. of recently delivered women he found an increased capacity; in 24 per cent. a slight diminution, and in 16 no alteration. These results have been met by other observers who affirm that the pulmonary capacity is lessened after labour. Systematic observations with the spirometer are needed.

Variations of Temperature in Childbed.

Under healthy conditions, individual and sanitary, no important rise of temperature is observed. Observations made

¹ Med,-Chir, Trans., 1882.

in lying-in hospitals which show a rise of over '5° Fahr. cannot be accepted as normal. A slight fall has been noticed twelve or twenty-four hours after labour. This is soon followed by return to the standard.

Slight oscillations may be accounted for by the natural rise towards the evening, by passing emotions, or irregularities of diet. Transient variations need occasion no anxiety, but it is far different when the rise is continuous and lasting.

Modifications of the Urinary Secretion.

To estimate these we must refer to the chapter on Pregnancy (vol. i.) for a statement of the character of the urine in that state. Lehmann states that the urine of very young children and pregnant women often contains very little phosphate of lime. The urine of women, not pregnant, contains more water, less salts, and less urea than that of men. These differences are especially marked in pregnancy. In the latter months there is often so little phosphate of lime that it is difficult to detect the presence of lime.

Winckel, ¹ Kleinwächter, ² Quinquand, ³ and others have studied the character of the urine in childbed. They generally agree. The quantity of urine is especially increased during the twenty-four hours after labour. The quantity may rise to 2,360 grammes; the mean is 1,600 grammes. In some women this transient polyuria appears on the second or third day. Winckel states the mean weight of the urine expelled during the first eight days by a healthy woman is on an average 12 lbs., or 1,175 grammes daily. The kidneys, therefore, eliminate a large quantity of water.

The specific gravity is generally diminished on the first and second day, varying from 1010 to 1018. When fever occurs, it may rise to 1020 to 1022. After the third day, the density increases to 1022 or more, even in cases where there is no fever. In the nursing woman, Quinquand says it may rise to 1025. Recently delivered women who are free from fever during labour excrete less urea than in pregnancy. Quinquand

¹ Studien über den Stoffweehsel bei der Geburt und Wochenbett, 1865.

² 'Das Verhalten des Harnes, &e., Arch. f. Gynäkol. 1876. Essai sur le puerpérisme infectieux, Thèse, 1872.

says, 'the quantity of urea eliminated in twenty-four hours, during pregnancy, exceeds the physiological mean, and varies from 30 to 38 grammes; whilst in the twenty-four hours following labour it falls to 20 or 22 grammes.'

The second day after labour the urea increases, but rarely

The second day after labour the urea increases, but rarely exceeds the normal quantity, unless fever intervene. On the third day, if there is no fever, the urea may exceed 30 grammes.

From the fourth day, if there is no fever, if there is milk and the child sucks well, the urea diminishes sensibly, and may fall to 19 grammes in the twenty-four hours. In suckling women, the average excretion of urea daily is 20 to 22 grammes.

The chlorides behave like the urea, that is, they diminish the first day, increase the second and third day, and diminish again when the milk has set in.

According to Winckel, during the forty-eight hours following labour there is a diminution of sulphates and phosphates.

The products of oxidation of the organism, of urea especially, would be in a larger proportion in the urine if they were not also eliminated by the lochia, sweat, and milk. The functions of the skin are more active some hours after labour, and continue very marked for five or six days.

The different secretions—cutaneous, renal, lochial, mammary—appear to supplement each other. The exaggeration of one may entail the diminution of the others: thus when the milk is abundant the lochial flow is generally less.

The increase of the excretions, the extraordinary elimination of the products of oxidation, the regressive metamorphosis of the uterus and other tissues, must entail a loss of weight in the puerpera. Gassner and Hecker established that during the first eight days women lose on an average 4,571 grammes, that is, about one-twelfth of their body-weight.

Glycosuria. Blot's statement that sugar is frequent in the urine of newly-delivered women has been sufficiently confirmed. De Sinéty, who had studied the question with especial care, showed that glycosuria can be produced at pleasure in suckling women by abruptly suppressing the milk. Sugar likewise appears in the urine whenever there is any obstacle to the secretion or flow of milk. When the production and yield of

¹ Recherches sur l'urine pendant la lactation, 1873.

milk are evenly balanced the sugar disappears from the urine. Towards the second or third day the milk sceretion is abundant and the child consumes but little; sugar is found in the urine. Tarnier and de Sinéty started the theory that the sugar eliminated by the kidneys was sugar probably made by the liver with a view to the lactcal secretion, and which could not be utilised in consequence of the temporary suppression of this function. But if this were so, why, of all the immediate constituents which enter into the composition of milk, is the sugar alone eliminated by the urine? To this Gubler answered that the passage of sugar—a crystalloid and dialysable body—is much more easy than that of albumen—a colloid body, which does not traverse the dialysers; that albuminuria always supposes a renal hyperæmia which borders on inflammation, whilst glycosuria is effected without any anatomical modifications of the kidneys.

De Sinéty observes also that the microscope reveals the presence, in all the saccharine urines of suckling women, of numerous fatty granulations insoluble in acetic acid, and coloured dark-brown by osmic acid.

The Changes in the Breast: the Secretion of Milk.

A fundamental anatomico-physiological fact must be borne in mind. The breasts are really skin-glands; they form a part, specially-developed, of the great glandular system of the skin. The secretion of the breasts assumes indeed a particular form, and is destined for a particular purpose, the nutrition of the infant. But the breasts do not on that account cease to take part in the great process of elimination which is carried out by the glandular system of the body. There is a physiological relation between the secretion of milk and the conversion of the tissue, which had been created for the purposes of gestation and parturition, into fat.

Women nursed in the lap of luxury, whose emotional and intellectual faculties have been indulged and cultivated at the expense of their muscular system, rarely acquire a healthy glandular development. The skin, become a thing of beauty, fails as an organ of health. Under the trial of purpery and lactation it breaks down. The breasts cannot perform their

duty, and more work is thrown upon other organs which also are likely to be inefficient. Hence it is that we so constantly find in women of the easier classes that lactation cannot be performed. Honest attempts are sometimes made; but after suckling with difficulty for a few days, during which time the infant suffers and pines, the milk is found to fall off; the breasts dry up, or become inflamed, and the cherished hope is abandoned.

Period of formation of milk. In some women a little milk may be squeezed out of the breasts during pregnancy; in others it oozes out spontaneously, soiling the linen; and in this manner the suspicion of pregnancy has been excited. But in most women no secretion of moment shows itself until after labour. The usual time of its appearance is the third day, rarely earlier; sometimes it is delayed until the fourth or fifth day, and in some it can hardly be said to appear at all.

The capacity for secreting milk furnishes another illustration of the aphorism that 'Pregnancy is the test of bodily soundness.' The woman may have carried her child with more or less comfort through gestation and labour, but at this point she may fail. This is especially the case with the daughters of Dives. The formation of milk is attended by certain local phenomena. The breasts immediately after labour are commonly flaceid or soft, and of the size they had attained during gestation. But in two or three days the breasts increase in volume, become firmer, even hard. The integument is stretched, smooth, shining, streaked with bluish veins which sometimes unite with those of the opposite breast. The nipple becomes less prominent, sometimes rendering suckling difficult.

Tarnier draws attention to the occasional appearance of subcutaneous ædema in the region of the areola. It is more frequent in primiparæ; it is frequent in domestic animals.

The changes in the proper structures of the breasts attending the formation of milk. The following account is drawn from Virchow, Kölliker, and Robin. Virchow, starting from the homology between the breast and sebaccous glands, says

² Cellular-Pathologie.

¹ The student should turn back to the section in which is described the Anatomy of the Breast (vol. i. p. 188).

that both are produced by a progressive proliferation from the internal layers of the epidermis. To the same category belong the ceruminous glauds of the ear, and the large glands of the axilla. In all these cases the fat which constitutes the chief constituent of milk, at least as far as its external appearance is concerned, and which furnishes the sebaceous secretion, originates in the interior of epithelial cells which gradually perish and set the fat free, whilst scarcely a trace of the cells is preserved. The sebaceous glands are generally seated on the sides of the hair-follicles at some depth below the surface; we there find a series of minute globules into which a prolongation of the rete mucosum is uninterruptedly continued. The cells of this become more numerous and larger, so as to fill the gland-sacs with a nearly solid matter. Then the fat begins to be secreted into their interior, at first in small particles, which soon become larger; and after a short time the individual cells can no longer be distinctly perceived, but only conglomerations of large drops, which rise up out of the gland into the hair-follicle. The secretion is a purely epithelial one, like the seminal secretion. This process furnishes us at the same time with an account of the formation of milk. One need only imagine the ducts much lengthened, and the terminal acini greatly developed; the process is essentially the same; the cells multiply abundantly; the multiplied cells undergo fatty metamorphosis, and ultimately there remain scarcely any material traces of these cells excepting the droplets of fat. The closest resemblance to the manner in which the secretion of sebaceous matter ordinarily takes place is presented by the earliest period of lactation, when the so-called colostrum is yielded. (The colostrum was discovered by Donné.) A colostrum-corpuscle is the stillcoherent globule which results from the fatty metamorphosis of an epithelial cell. The formation of colostrum and sebaceous matter differs in this respect only, that the fatty granules remain smaller in the former case, and that whilst large drops very soon show themselves in sebaccous matter, in colostrum the last cells which are observed usually contain only minute fat granules, very densely aggregated, whereby the whole cell acquires a somewhat brownish appearance, although the fat has no natural colour. This is the granular corpuscle 'corps granuleux,' of Donné. For the discovery of this gradual

a number of comparatively large and small drops of fat mixed up together, the so-called milk-corpuscles, which are nothing more than drops of fat, and, like the majority of the drops of fat that occur in the body, are surrounded by a delicate albuminous membrane called by Ascherson the haptogenic membrane, i.e. produced by contact. But the individual drops, milk-corpuscles, correspond to the drops which we find in the sebaceous matter. They are produced by the coalescence of the minute granules which appear in the secretion of co-

lostrum.

This haptogenic membrane was admitted by Henle, Dumas, Robin, Frey, and Kölliker, but it seems to have been definitely proved by de Sinéty that its existence is due to accident. Thus, when the milk is examined immediately after being drawn, and the use of coagulating reaction is avoided, this envelope is not found.

The colostrum-corpuscles characterise the first milk. After a few days they generally disappear, and nothing is seen under the microscope but highly refracting oil or fat droplets of various sizes. Kölliker cites Donné as stating that in inflammations and swellings of the mammæ during lactation the milk assumes the nature of colostrum. This is contradicted by d'Outrepont and Münz.² During menstruation, Donné and d'Outrepont found colostrum-corpuscles in the milk. This fact Robert Barnes has verified; he found colostrum-corpuscles reproduced at every menstrual period, lasting for seven days or more, and then disappearing in the intervals. Lehmann states that they occur in the course of any acute affection which may

¹ Archives de physiologie de Brown-Séquard, Charcot, et Velpeau.

² Neue Zeitschrift für Geburtskunde.

supervene during lactation. Donné regarded them as proof of bad milk. In the foot-rut of animals Herberger and Donné found the milk to possess more of the characters of colostrum. In milk which has become sour, the caseine is found coagulated in the form of granules, and the milk-globules gradually coalesce into larger drops. Blue and yellow milk contains, according to Fuchs, infusoria, themselves without colour, which he called *Vibrio cyanogenus* and *xanthogenus*. These, when mingled with healthy milk, will impart a colour also. This is confirmed by Lehmann for blue milk. According to Baillent ² and Lehmann a fungus also exists in such milk. C. Nägele has observed red milk, and found a vegetable formation of the nature of a protococcus in it. But pinkish milk may be suspected to contain, and Hassall figures, blood-globules in such milk.

Milk consists of a fluid portion or plasma holding in suspension innumerable round, dark, shining corpuscles varying in size. These are the milk-globules; it is to these corpuscles that the milk owes its white colour. In fresh milk these corpuscles are animated by Brownian movements.

Breast abnormalities. 1. In defect. In some women the breasts are so little developed that they are unfit for the secretion of milk.

2. In excess. Supernumerary breasts and nipples.

Reflecting on the histological identity of the sebaceous and mammary glands, we can readily understand the occasional development of the breasts in men and the formation of milk in them. Not to mention other examples, there is the famous one recorded in John Hunter's Notes and Essays (edited by Owen). A man, aged 50, had married a woman who fourteen years before brought forth twins, male and female. To soothe the male child, the father used to apply his left nipple to the infant's mouth; the child drew milk and throve upon it. This man treated eight succeeding children in the same way, sharing the duty of suckling with his wife. But what is very remarkable is, that he had a constant flow of milk for long after he had ceased to suckle. The lymphatics, blood-vessels, and conglomerate glands of his breasts presented the same appearance as in

¹ Comptes Rendus, xviii.

² See Scherer, art. 'Milch' in Handbuch des Physiologie.

women. He stated that when he suckled the first child all his natural secretions were diminished, especially the sweat, which he was much subject to before; and that he had not the slightest appetite for venery for several months after.

The duration of milk secretion. The usual duration of the capacity for suckling may be stated at nine months. But in many women, chiefly of the labouring class, suckling is protracted to twelve months or even longer; and we have known instances of women who, having lost their husbands, have concentrated their womanly instincts upon the child at the breast, who have continued this duty for over two years. We have even seen a child get up on a stool and stand whilst suckling. In such cases the breasts retain their dominion over the ovaries; menstruation may be performed, but this function is often disturbed or suspended.

A condition analogous to the above is seen in women who give themselves up to the duty of wet-nursing. These sometimes will persist in nursing for eighteen months or more. We have known an example of a Spanish wet-nurse who nursed three successive children in one family; and we are informed that it is the custom in some parts of Spain to engage a wet-nurse who, having suckled the first child, will take up in succession all the children her mistress may bring forth, herself living all the while in celibacy.

We also know a lady, richly-endowed physically, intellectually, and artistically, who, living with her husband, and menstruating regularly, has nevertheless gone on secreting milk five years after the birth of her only child, which she suckled only for a short time.

What to observe in the Puerpera and her Child.

Take the catheter, thermometer, and stethoscope as companions.

Objective observations. 1. Count the pulse, note its rhythm and strength (sphygmographic observations also may be useful).

2. Count the respirations, note their depth.

3. Note the temperature in mouth or axilla, and exceptionally in vagina.

4. Note aspect, manner and speech, and the tongue.

5. Apply hand to abdomen, to note flaccidity or tension,

pain. If tension and pain, note shape of abdomen, and define area of dulness or resonance. If dulness extend to umbilicus or nearly, pass the catheter.

6. The state of the genital organs. It is desirable at some time to examine by touch to ascertain if the uterus is in normal position. The perinæum, as to integrity. The discharges. Watch the involution of the uterus by its retreat towards the pelvis.

7. The breasts. State of nipples, as to form, size, integrity. State of breasts as to size, uniformity of consistence, tenderness, secretion of milk. The quantity and quality of the milk, ease

of yielding; microscopical characters.

The observations to be made by the attendant on the day after labour, and from day to day. Interrogate all the functions. The aspect of the patient, her manner, her voice, and mode of answering questions tell nearly enough the state of her brain. Has she pain? Generally there is a sense of muscular soreness and fatigue. Feeling the abdomen, we ascertain if there is tenderness on gentle pressure, and if the abdomen is tense or flaccid. If there is tenderness or prominence, or both, this may be due to intestinal distension, to rulness of the bladder. The real condition of the bladder must be determined. Inquire into the state of the bowels. The rectum was probably unloaded during the labour, and for two or three days after it is usually sluggish. If there is diarrhea we must look to the associated symptoms. Ask the patient if she can freely move her limbs. There should be no difficulty in this except the sense of soreness. Note three points especially, and record them-pulse, temperature, and respiration. The pulse should be 70 or 80, if even lower but steady it is good; the temperature should be 99° Fahr.; the respirations 18, or not exceeding 20, in the minute, easy, the chest expanding.

Inquire as to the *lockia*, see the napkins. Feel the *breasts*. On the second and third days there may be no sensible difference in their condition, but at the end of the third, and more generally on the fourth, the breasts are usually fuller, firmer, somewhat tender, and milk may ooze from the nipples.

Subjective Information, and from Nurse or Attendants.

- 1. As to nutritive functions, appetite, digestion (vomiting? colic?), defectation, micturition. Are the stools or nrine passed naturally?
- 2. Respiration: distress in breathing? Circulation: palpitation?
- 3. Innervation: sleep; sense of ease, lassitude, or depression; headache or not; the condition of the taste, smell, hearing, sight, sensation; have speech and manner been natural? test the power of moving the limbs. As to rigors. As to abdominal pain (inflammatory or colic); as to uterine pain (after-pains); as to pains in limbs and joints.
 - 4. The skin: heat, moisture, perspiration, odour from.
- 5. The excretions: by lungs, by skin, by bowels, by bladder, by vagina. The lochia especially as to quantity, colonr, odour. Is there any shred, membrane, or unnsual complication? One rule is important. Do not suffer the nurse to answer questions you address to the patient.

The favourable signs are: pulse not exceeding 90; temperature 99° Fahr.; soft, painless abdomen, bladder acting naturally; spirits cheerful.

All these observations will be made with the least possible disturbance of the patient. Some will be made almost without her conscionsness or attracting attention of attendants; some may be pretermitted on occasion. They should be made in a certain order, so as to ensure that nothing important is omitted, and to avoid fatiguing the patient by repetition. These observations methodically taken will serve to recall the chief points in the preceding history of the pucrpera. By turning back to the description the reader or practitioner may refresh his mind as to the significance of the points noted for observation. He will appreciate any departure from the standard conditions; if any new interposing condition is observed we may draw information of diagnostic, prognostic, and therapcutic value. And, lastly—a point not to be disregarded—we add to onr own value as scientific clinical physicians by a course of study rich in physiological and pathological illustrations.

The Care of the Woman recently delivered and her Child.

- 1. The hands which have helped to squeeze out the placenta, or simply to second the expulsive contractions of the uterus, will give information as to the condition of the organ. If it be well contracted, the woman may take a little rest to allow her to recruit her nerve-force, always watching to ascertain if the uterus relax. In pluriparæ, thirty minims of ergot may now be given to promote contraction. But it must be specially borne in mind that it is bad practice to give ergot before the uterus is empty both of placenta and clots. Ergot is very apt to induce spasmodic contractions of the lower segments of the nterus, and thus to imprison whatever may be in its cavity.
- 2. If there be spasmodic or colic pains after the extrusion of the placenta, the first thing to do is to make sure that the bladder is empty. Use the catheter. This done, tight compression of the uterus by the hand, to provoke contraction, may be used.
- 3. Cleansing the genital parts. If sponges be used, they should have been soaked in a solution of 1 in 50 of carbolic acid, and fluid of the same kind should be used. The fluid should be squeezed out of the sponge so as to run in streams over the part, rather than to wipe or rub. The labia majora and minora may be held gently apart to let any clots escape from the vagina. Wadding should be used instead of sponges, and be burnt after use.

If there be retention of blood or clots in the vagina, gentle

syringing with the carbolic solution may be practised.

4. This is the time to ascertain if there is any lesion of the perinæum or vulva. If there be only slight rent, no operation is necessary; if a rent extend to near the sphincter, and, à fortiori, if it involve the sphincter, the wound should be united by silver wire sutures. Three or four will commonly be required. The first should be passed deeply close to the anal extremity of the split, the others less deeply as we approach the anterior edge of the perinæum.

5. The dressing of the vulva usually consists of folded diapers. We strongly advise that this practice should be discarded. We can rarely feel sure that 'things coming from the wash' are pure. It is best to use pads prepared with carbolic

acid or other trustworthy antiseptie, or the carbolised gauze used in surgery. These should be renewed as often as soaked, and burnt. We thus not only avoid one source of danger to the patient in charge, but avoid the risk of propagating infection to other persons.

6. The binder. A revolt was some time ago raised against the traditional practice of binding the abdomen after delivery. It did not succeed. The objections to the binder are unsound, whilst the uses of it are clear and decided. In pluripare, especially, the abdominal walls are extremely flaccid. The sudden expulsion of one-tenth of the body-weight from the abdominal cavity is attended by a sudden removal of a force hitherto pressing upon the vessels and organs of the chest, abdomen, and pelvis. This entails in some cases a tendency to vacuum. Hence disturbance of the circulation. Now the binder, by supporting the abdominal walls, restores the equilibrium of pressure. The pressure exerted upon the uterus works as a gentle continuous stimulus to contraction. The woman is conseious of the support and is grateful for it.

The abdominal walls, thus supported, now quickly regain tonicity, and return far more nearly to their pristine strength and flatness. The figure, so precious, and rightly so, to women, is better preserved.

The application of the binder. If a marked void is left in the hypogastrium, it is well to fill this up with a pad composed of cotton-wool carbolised, wrapped in prepared gauze. A broad stout towel will answer for a binder, but a bandage cut to the shape is better, as admitting of more accurate adaptation and keeping its place better. The patient lies on her back, the legs extended. Thus the lower margin of the binder seizes the hips well: the pressure obtained is more uniform, and the binder is less likely to slip up. So applied, the binder becomes one of the most efficient agents in antiseptic midwifery; it keeps the walls of the uterus and vagina in contact, thus preventing the collection of fluids or clots, and shutting out air.

Before leaving a patient, the genitals should be finally examined to see if there is any discharge.

The first care given, consecutive care arises. The woman should, if possible, be visited again within five or six hours after labour.

CHAPTER III.

THE NEW-BORN INFANT.

Changes on Transition from Intra-uterine to Extrauterine Life. Asphyxia.

During intra-uterine life all the processes connected with hæmatosis and nutrition in the fœtus are carried on through the medium of the placenta. It is usual to regard the placenta as the equivalent of the lung in the air-breathing animal. This Robert Barnes long ago showed 1 to be a very inadequate estimate of this organ. The placenta really performs not only the duty of the lung, but, in great measure at least, that of the skin, intestines, liver, and kidneys—organs which cannot be said to enter into full function until respiration is established—another proof of the solidarity of these organs. The substitution of the lung for the placenta is the signal of a great and sudden revolution. The new functional régime is attended by a physical change in the organs. The fundamental changes are those that take place in the circulation. The changes in the other organs are secondary.

To take the changes in something like a natural order, we may enumerate the organs of circulation, the composition of the blood, the pulse, respiration, calorification, digestion, renal secretion, the skin, lacteal secretion, and the general growth of the new-born infant.

A brief recapitulation of the principal features of the fœtal circulation will be useful. The blood, which has been hæmatosed in the placenta, comes back to the fœtus by the umbilical vein, and soon divides into two currents: one proceeds by the ductus venosus, and is rapidly carried by the vena cava

¹ Medico-Chirurg. Rev., Articles, 'Placenta,' 1854.

inferior into the right auriele; the other, accessory, traverses the liver, following the ramifications of the vena portæ and the hepatie veins, to terminate in the right auricle. Besides this, the inferior vena cava brings into this auricle the blood from the head and upper extremities. Into the left auricle there is poured a small quantity of blood, coming from the lungs. When the heart contracts, a part of the blood of the right auricle—or, more strictly, the blood coming from the vena cava inferior—is projected into the left auricle through the foramen of Botal. A small part only of the blood which comes to the right auricle reaches the corresponding ventricle. what it receives the smaller part only traverses the whole length of the pulmonary artery; the greater part is sent to the aorta through the ductus arteriosus. The left ventricle receives all the blood coming to the left auricle, whether by the foramen of Botal or by the pulmonary veins, and projects it into the aorta, where it is soon mixed with that coming from the duetus arteriosus. From the aorta the blood is distributed into the arteries which supply the head, arms, trunk, legs, and, lastly, into those arteries which return it to the placenta—the umbilical arteries.

The transformation of this provisional circulation into the definitive circulation is effected by the obliteration of the umbilical vessels, of the ductus venosus, of the foramen of Botal, and of the ductus arteriosus.

We must take these phenomena in order.

Obliteration of the umbilical vessels and fall of the cord. When the blood-current is turned off from the placenta, the vessels of the cord are obliterated. The arteries retract and become impervious; a clot is formed in the vein. During the following days, the bit of cord remaining attached to the umbilieus shrinks, dries, and at last is changed into flat, horny, transparent membrane, through which are seen black lines, the remains of the umbilical vessels. The dried cord is now a foreign body as regards the living tissues of the umbilicus. At this point the skin reddens, and presently there is formed between it and the eord a circular groove filled with limpid, sero-purulent liquid. This groove deepens, and the cord is lost in about five days. The little wound resulting becomes eovered with granulations, and usually cieatrises in eight to ten days.

The sore left by the fall of the cord is open to attack by dirt, by bacteria, and is a route for absorption of septic stuff. Hence erysipelas and other diseases. The fall of the cord may be delayed when it is unusually thick, or when, as Tarnier observed, it is dressed with carbolic acid. When the child is ill, the cord, instead of drying np, remains moist, putrefies, and gives rise to a foul odonr.

Richet submits that the cord dies because it is strangled at its root by a circular band of muscular fibres, forming an umbilical sphincter. Parrot, however, maintains that the cord dies because it has no nutritive vessels, so that, when no longer nourished by the liquor amnii and by the blood running in the umbilical vein and arteries, it perishes. This is the general opinion. The cord falls like an eschar.

Obliteration of the umbilical vessels inside the abdomen. This process has been studied by Robin. It begins before the fall of the cord. It is very advanced at the end of the third week, and is complete at the end of the first year. The retraction of the vessels is attended by their adhesion to surrounding tissues. The two internal tunics of the arteries, retracting towards the pubes, at last occupy the sides of the bladder; the vein, contracting towards the liver, forms the falciform ligament. The retraction begins from four to eight days earlier in the arteries than in the vein. The internal tnnics become atrophied; the external tunics become hypertrophied throughout their length. Lastly, the walls of the vessels form adhesions on their inner surface. Thus the obliteration of the vessels within the abdomen is effected. The vessels are thus transformed into three fibrous filaments adhering to the umbilical ring. The bundle of arterial ligaments inserted in the cutaneons scar pulls this down, so that at the lower half of the umbilions there is produced a crescentic depression, the concavity of which looks upwards.

Obliteration of the venous duct. This, which is only a division of the umbilical vein, like it is obliterated and transformed into a fibro-cellular cord after birth.

Obliteration of the foramen ovale. The opening in the anricular septum persists throughout feetal life. It closes after birth, but the conditions merit further study. The septum presents a crescentric fold, with the concavity posteriorly. At

the same time, and advancing to meet it, there is developed a membranous fold, a valvule, which is destined to aid in the closure of the foramen. This fold proceeds from the left side of the mouth of the vena cava inferior; it grows from behind forwards; its anterior edge is crescentic, like the posterior border of the inter-auricular septum. The two extremities of the crescent of the valvule of the foramen ovale terminate in columns, one upper, one lower, which are inserted on the anterior wall of the auricle. The foramen thus bounded is gradually narrowed as the valvule grows. It has usually closed in fifteen days. From this moment the valve, growing, covers the anterior edge of the foramen, and doubles the septum. Some months after birth the valve has acquired a thickness nearly equal to that of the inter-auricular septum. It is rare to find that part of the anterior edge of the valve which is included between the two columns adheres completely to the wall of the left auricle, to which this border is applied. Generally a probe can be passed beneath it, which at a short distance is either arrested in a cul-de-sac, or passes from one auricle into the other. The latter is the more frequent. Da Costa Alvarenga found obliteration complete in 8 cases only out of 213.

Robert Barnes had made similar observations. But it does not follow that, because an anatomical communication may exist between the two auricles, the blood must pass from one auricle to the other. During the auricular systole, the blood presses the valve over the opening, thus opposing a mechanical barrier; and at the same time the physiological impulse directs the current of blood from each auricle into its corresponding ventricle. It is quite possible even for two streams, each having its proper destination, to run side by side without a septum, to preserve themselves from admixture. We see examples of two streams running side by side in the confluence of rivers. When the physiological attractions and impulses are disturbed and anatomical defects are marked, then the streams are apt to mingle.

Obliteration of the ductus arteriosus. This takes place nearly at the same time as that of the foramen ovale. The recent observations of Walkhoff, verified by Parrot, show how it is effected. From the second day the middle coat becomes

thickened by the nuclear proliferation of its fusiform cells. The inner coat undergoes a similar change; the nuclei of its epithelium and of its superficial connective layer multiply so as to form a triple row, giving to the canal a velvety aspect. On the fifth day the proliferating elements of the middle tunic push the internal tunic inwards, forming longitudinal folds. Fibrinous concretions complete the closure of the canal about the fifth day. The ductus arteriosus is thus converted into a ligament, in which are sometimes found hæmatoidine and carbonate of lime.

At the same time that these phenomena of obliteration and atrophy take place in certain branches of the circulating system, other vessels open up to deliver the blood freely to its new destinations. Thus, the trunk of the pulmonary artery seusibly enlarges, because the blood, which previously passed through the foramen ovale and the ductus arteriosus, must all go into the pulmonary artery and its divisions to reach the lungs. The pulmonary veins, which bring back the blood from the lungs to the left auricle, undergo corresponding development.

The digestive organs, inert during feetal life, euter upon function, and then the corresponding vessels—the system of the vena portæ particularly—enlarge considerably.

The left ventricle, which during feetal life was thinner than the right, grows rapidly, and soon acquires the relative thickness which is observed in adult life.

The arterial tension of the uew-born child corresponds, according to Vierordt, to 111 millimetres of mercury—that is, sensibly less than in the adult, in whom it corresponds to about 200 millimetres.

The pulse in the new-born child. Billard, Jacquemier, Trousseau, Valleix, Parrot have studied this subject. The radial artery is hard to feel; one must auscultate the heart. Trousseau says it beats about twice as quickly as in the adult—that is, about 137 in the minute during the first two mouths; 128, from two to six months; 120, from six months to a year; 118, from one year to tweuty-one months. Sleep or wakefulness affects it. It may be 142 when awake, and only 124 when asleep. Parrot found that the pulse was liable to great variations under the influence of movements, crying, and external

impressions. The pulse is less frequent in vigorous children than in delicate ones. In healthy new-born children the pulsations are regular, strong, clear, and uniform. When they are accompanied by a *bruit de souffle*, there is a fault of structure of the heart, as persistence of the foramen ovale, or a communication between the two ventricles.

The blood of the new-born infant. The quantity is estimated by Welcker at nearly $\frac{1}{20}$ of its body-weight, whereas in the adult it is $\frac{1}{13}$. The specific gravity is also less. Denis found it to be between 1,045 and 1,049, whereas in the adult it is from 1,052 to 1,057.

Professor Hayem ¹ has studied the characters of the blood. At first, by the naked eye, it is seen that the blood flowing from the cutaneous capillaries is black, like the venous blood of the adult. This colour, very evident in the child which has made but a few respirations, diminishes in depth in a few hours. The same character is manifested in the dark-purple face of the new-born before it has breathed well, and the rapid change to a brighter hue as soon as respiration is established. This dark colour may, however, not be so marked in the fœtus whilst it enjoys placental respiration. It may be transitional, existing only during the interregnum between the loss of the placental action and the establishment of aërial respiration. But the blood is still darker than in the adult ten days after birth.

The red globules are much less uniform than in the adult. The largest exceed the largest of the adult, the smallest are smaller. Otherwise expressed, we meet giant and dwarf blood-corpuscles. These globules are found in varying proportions from day to day. Hayem and Cadet found the red globules more numerous than in the adult. Neumann says that a certain number of red globules possess a nucleus. The hæmo-globin is of about equal value in the new-born and the adult.

At the moment of birth, the white globules are smaller and much more numerous than in the adult: that is, about one white globule to 300 red in the new-born, against one in 800 in the adult.

The hematoblasts resemble those of the adult, but are much less numerous—that is, 33 times less numerous than the

¹ Comptes rendus de l'Acad. des Sciences, 1877.

red globules in the new-born, against 19 times less in the adult. During the first days—that is, whilst the child is losing weight—the number of white globules falls to 6,000, or even to 4,000, whilst that of the red globules rises; then an inverse movement takes place, so that in the second week the white globules have risen to 7,000 or 9,000, and the red globules have fallen by 500,000. In short, whether we look at the globules, white or red, or the hæmatoblasts, all the elements show constant variations of form and number—signs, as Hayem says, characteristic of blood in the process of evolution.

Respiration. A healthy child as soon as it is born breathes and utters a cry. What is the cause of the first inspiration? Marshall Hall contended that the first respiratory movement is a reflex act provoked by the contact of the air upon the skin of the fœtus as it emerges from the mother. Vierordt contended that it is due to excitation of the medulla oblongata by blood charged with carbonic acid in excess, in consequence of the suppression of the placental respiration. This explanation is supported by the fact that during intra-uterine life the fœtus makes inspiratory efforts when threatened with asphyxia. Robert Barnes believes that both factors, and that yet a third, are concerned. Thus, (1) the fœtus, failing to receive purified blood from the placenta, tries to breathe, whether still in utero or not; (2) the influence of air upon the respiratory nerves is too obvious and familiar to be disputed; (3) the sudden liberation of the child's chest and abdomen from the compression to which they are subjected during the final act of labour, involves a rapid expansion of the chest-walls and abdomen, setting-up a vacuum suction action. This is illustrated by what occurs in the practice of the various methods of inducing artificial respiration. The concurrence of these three factors is almost constant.

In any case, the air penetrates into the lungs, and if auscultation be practised at this moment, as Tarnier and Cornil discovered, a fine crepitation-râle is heard, probably due to the opening out of the pulmonary alveoli.

The respirations are more frequent in the new-born than in the adult. Great variations are observed. Parrot found the respirations in 22 sleeping children to give a mean of 51.54 and in 12 waking children, 51.16. That is slightly more

frequent during sleep. It was nearly equal in boys and girls.

The respiratory type is the abdominal at first. The enlargement of the chest is mainly effected by the descent of the diaphragm; the anterior abdominal wall becomes strongly convex at each inspiration. Depaul says that during waking the respiration is more costal.

Bouchaud estimates at 45 grammes in 24 hours the pulmonary exhalation in a child five days old.

The temperature is best taken by placing the thermometer in the rectum. At birth the temperature is 37·25° Cent., slightly in excess of that of the mother's vagina; but Parrot says it is a little less than that of the uterus, which under the influence of labour rises to 38°, 38·5°, or more. In any case, the temperature falls sensibly during the half-hour following labour, and this fall is more marked in proportion to the debility and immaturity of the child. The new-born has little innate power of generating heat; it depends greatly upon the supply of external warmth. In the Paris Maternité Tarnier puts weakly and immature infants into a specially constructed 'couveuse' or 'incubator.'

In healthy children the temperature soon rises as the respiration becomes established, and reaches to 37.5° or 37.6° Cent. Tarnier insists that, the pulse being so variable, the observation of the temperature is especially valuable as a test of fever in the infant.

Digestion. The act of suction consists in the grasping the nipple by the upper jaw and lip above, and by the tongue and lower lip below; the palate being lowered and closing the mouth behind, aspiration is effected by a movement of the tongue and lower jaw, which make a vacuum by being drawn back. The cheeks are seen to fall in between the alveolar arches. The milk then comes into the mouth, the cheeks become distended, the child swallows, and a sound is heard during deglutition. Failure in the integrity of any of these organs defeats the production of a vacuum. Thus hare-lip and cleft-palate may lead to starvation. Milk hardly undergoes any change in the mouth. But an interesting practical question arises whether starch-foods are susceptible of transformation into sugar under the action of the saliva,

as in adults under the influence of ptyaline. Burdach, Joerg, Bidder maintained that for six or eight weeks the salivary glands were so little developed that they could hardly secrete any saliva. Vogel contended that there is enough saliva to act in a small degree; and Zweifel, by separate observations on the different glands, found that ptyaline existed only in the parotid glands in the infant at term, the sub-maxillary glands developing it later. In any case, the power of transforming starch into sugar is feeble, and the indication is clear against cramming the infant with pap.

Stomachal digestion. The stomach of the new-born infant is of small capacity. Fleischmann estimates it at 46 centimetres during the first week, at 72 to 82 during the second week, at 80 to 92 during the third and fourth weeks, at 140 in the third month, at 260 in the fifth month, at 375 in the ninth month. But the variations are great. At birth the direction of the stomach is nearly vertical, instead of horizontal as in the adult, so that the food passes rapidly through it, when the child is held upright. Its muscular walls are as yet very little developed. Hence food should be given in small quantities and at short intervals; and albuminoid foods should be of easy digestion, since they remain for so short a time in the stomach.

In the stomach the milk is coagulated by the gastric juice, and the whey is separated from the fat and caseine. The whey or serum is directly absorbed. The caseine and other albuminoids are transformed into soluble substances, easily assimilable. Zweifel and others have shown that the albumen of the egg is more difficult to digest than caseine; and what is very important, this substance itself is less easy to peptonise if it comes from cow's milk than from woman's milk. An excess of acidity of the gastric juice may also cause large clots of caseine hard to digest. The acid of the gastric juice can dissolve the gelatinous substances sometimes given; also the salts of lime, the absorption of which is useful for the development of the osseous system. It has also the property of preventing putrefaction.

The sugar of milk is transformed by the stomach into grapesugar, but the transformation is chiefly effected in the intestine.

Intestinal digestion. The albuminoid substances not dis-

solved in the stomach pass into the duodenum, where the pancreatic juice changes their reaction from acid to alkaline, and then dissolves them by peptonisation by a ferment called by Kühne trypsine. Zweifel showed that the pancreatic juice dissolves albuminoids, but has not the power of transforming starch into sugar. He also showed that, as in the adult, the pancreatic juice possesses the property of making an emulsion of fats, and of converting them into acid fats and glycerine.

It shares the property of making fat emulsions with the bile, which is poured into the duodenum along with it, and which is probably abundant, for the liver is very large, and bile elements are found in great quantity in the fæces.

When bile and pancreatic juice are deficient, the fatty matters are not completely absorbed, and are found in the stools. Then are seen the *fatty stools* described by Wegscheider.

Absorption is very active in the small intestine, on account of the villi and the numerous folds of the mucous membrane.

Bile prevents putrefaction of the contents of the intestine in an alkaline medium, as the gastric juice did in an acid medium in the stomach. The rapid transit of the food also obviates putrefaction. Hence the stools of infants are almost inodorous, unless the order and relation of the processes named is disturbed.

The evacuations. At the end of fœtal life there is an accumulation in the large intestine of a substance called meconium (from $\mu\acute{\eta}\kappa\omega\nu$, poppy), from its resemblance to poppyjuice. It is a viscous matter of bottle-green colour. It is formed of a mixture of mucus, epithelial cells, and of bilematters, which keep it from putrefaction. It is not generally voided before birth. Evacuation is a respiratory act. So, when breathing is established, the diaphragm and abdominal muscles contract and empty the bowels. The exceptional cases of meconium-evacuation before birth will be described in connection with breech-presentations, head-first, and other labours, where the circulation has been interrupted.

The meconium is for the greater part voided during the first twelve hours, but the expulsion goes on for three or four days. Depaul estimates the quantity of meconium in the intestines at birth at 74 grammes.

When all the meconium is voided, the stools contain the VOL. II.

residuum of digestion, and vary according to the diet. When the child is fed from the mother's breast, and colostrum or colostrum and milk form its food, the stools are of light consistence, of light green colour; and these characters may persist for some weeks. When a child is taken to nurse by a woman whose milk-secretion is fully established, the colostrum period being passed, it is not rare to see the stools yellow during the first days.

When the digestion is good the stools are bright yellow, of the consistence of thick soup, homogeneous, odourless. The colour is due to the colouring matter of bile, bilirubin.

Sometimes the stools are greenish when voided, or become so on exposure to the air. This is a sign of bad digestion. The colour is due to biliverdin; and in this case we find small quantities of the bile-acids not transformed, such as acids of the formic group: capric, stearic, palmitic. There is a sour odour like that of sour milk. Sometimes this condition is corrected by alkalis, as of lime or soda, which, neutralising the acids, prevent the oxidation of the bilirubin and its transformation into biliverdin. But sometimes it is necessary to change the food.

The faces of infants at the breast are usually homogeneous, consisting of different substances well mixed: epithelial débris, mucus, caseine, neutral fats in the form of fat globules. If the stools are mixed with water these globules rise to the surface.

Sometimes there are found in the stools large whitish flakes, not intimately mixed with the other ingredients. This happens chiefly under the use of artificial food. These flakes are a 'sign of imperfect digestion, either from the food being unsuitable or too plentiful.' These flakes have been looked upon as coagula of caseine, but Wegscheider says they are formed entirely of neutral fats mixed with epithelial débris.

The number of stools in a healthy infant is two to four daily at the beginning, and later one or two. Marked deviation from this standard, either in excess or deficiency, is evidence of disordered digesticn or of unsuitable food.

Reichardt found the dry residuum of the stools after evaporation to be about fifteen per cent. in an infant of three months. In the dry residuum Simon found among other substances in a

child six days old fifty per cent. of fat and eighteen per cent. of caseine.

The urine. At the moment of birth the bladder always contains a certain quantity of urine, unless the abdomen have been compressed during labour, as it is in breech-presentations, and unless the fœtus have suffered compression. In the latter case the sphincters relax and the urine and meconium escape. Under ordinary conditions the urine is voided within twenty-four hours of birth, sometimes immediately after birth. The first micturition amounts to about 10 cubic centimetres. During the next two or three days the quantity is small, because the quantity of milk absorbed is small. Bouchaud estimated that 643 grammes of urine passed corresponded to 1,000 grammes of milk imbibed.

During the first days, whilst the child is losing weight, the colour of the urine may be as deep as in the adult; but it soon becomes pale-straw, or nearly colourless. The first urine has a density of 1,005 to 1,006; later it falls to 1,003 or 1,004.

The urinary deposits. The urine of the new-born infant deposits 1st, epithelial eells from the inner surface of the urinary apparatus, bladder, ureters, pelvis and tubules of the kidneys; 2ndly, crystals of uric acid, in small rhomboidal plates, transparent; 3rdly, oxalate of lime in oetahedra; 4thly, oxalate of soda in ovoid rods or spherules.

Chemical characters.—G. Sée contends that the analysis of the urine can give more precise information as to the nutrition of the infant than weighing it. The reaction of the urine in healthy infants is neutral. If found acid, Parrot submits that the child is out of health.

The quantity of urea. The urine of the new-born infant contains urea, but in such small proportion that its existence has been contested. On the third day it becomes more obvious, and it increases in quantity after the tenth day, so that between two and five months the daily exerction rises to 3 grammes, and in the third year to 14 grammes, or about half the quantity passed in adult life. This is the statement of Martin and Ruge, but Parrot and A. Robin have arrived at somewhat different results; they, however, agree that the quantity of urea excreted increases after the tenth day. Parrot says that an infant kept in a warm medium excretes more urea.

Uric acid is found in the urine of infants at the breast. It increases during the first days, then diminishes, then again increases and becomes more copious than in the adult.

Uratic infarctus in the kidneys. A remarkable condition sometimes found in the kidneys of new-born children is the uratic infarctus. Concretions of uric acid salts are found in the form of small yellow cylinders, filling the tubes of the pyramids near the hilum. When the summit of the pyramids is squeezed a yellowish dust comes out. A similar dust is found in the calices and pelvis, in the bladder, urethra, and sometimes even on the prepuce. Virchow says these uratic infarctuses are composed of crystals of urate of ammonia. Parrot demonstrated them to consist of urate of soda. Virchow regards them as physiological. Parrot thinks they are the result of athrepsia. He says in this affection there is insufficient combustion of the waste-stuff of nutrition, for the hæmatosis, much weakened, does not bring oxygen in the necessary quantity for this combustion. The elements of disassimilation, instead of being transformed into urea, remain in the state of uric acid. On the other hand, in athrepsy the vomiting and diarrhea entail a considerable loss of water of the blood, so that there is not left enough to dissolve the salts which result from the combination of the uric acid with the soda. Thus the salts form the deposits described. It is a pathological phenomenon. These concretions are not found in healthy children.

Vierordt also notes in the urine of the new-born a substance distinguished as *allantoin*, a product of the oxidation of uric acid, but to a less degree than urea. Allantoin is found only during the first days; it disappears in the second week under the form of urea.

Dohrn found traces of *albumen* immediately after birth. It is more abundant in children who endured disturbances in the circulation during labour, and especially in the still-born. Parrot and A. Robin say the urine of healthy infants is free from albumen.

Pollak says the urine of children at the breast contains small quantities of grape-sugar; but this has not been confirmed.

Inorganic substances. Chlorides, phosphates, and sulphate

are found. The urine of the new-born holds faint traces only of chlorides and sulphates.

Modifications of the skin in the new-born. These may be classed as changes of colour, desquamation, and cutaneous excretion.

Colour. The fœtus at birth is covered more or less completely with a greasy, whitish matter, which may hide the colour of the skin. When the child has fairly breathed, the skin is light, or even deep, red. This tint lasts three or four days, gradually fading; but it may last longer. It is more pronounced and lasting in delicate and premature children. This is the sign of difficulty in the circulation. It persists longest in the extremities, which are bluish. Often about the third day it gives way to a subieteric tinge. Most frequently this is not icteric, but is due to transformations in the colouring matter of the blood, which fills the cutaneous and sub-cutaneous tissues—that is, to a hamapheic jaundice. In the more severe forms of jaundiee there seems to be a strong hereditary tendency. Robert Barnes saw a child, whose parents were apparently healthy, which died a few days after birth of jaundice, gradually increasing in intensity. This was the eighth child in succession, all of which died in the same manner.

Children born of black parents are not at first black of skin. It is chiefly at the umbilical ring and on the scrotum or labia majora that black pigmentation is observed.

Sometimes nævi materni are seen. We do not speak here of those nævi of pathological significance, but of spots which appear in many children, and which disappear spontaneously after a short time. They are of deeper red than the rest of the skin, are effaced under pressure, and seem due to increased vascularisation. They are not raised above the skin-level, are irregular, often multiple, and are principally seen on the eyelids, on the face, forehead, and lips. They almost always disappear in a few months.

Occasionally we see on the skin of the face a kind of sebaceous acne formed during the latter months of intrauterine life.

Desquamation. Soon after birth, the skin cracks and forms shreds of epidermis, which soon separate. Sometimes this exfoliation is effected in small scales, as in the furfuraceous

desquamation of rubeola. Parrot says, "it appears in premature children very slowly, whereas in those born at term it sets in on the first or second day, and is in full activity on the third or fifth. It is completed at variable dates from the thirtieth to the fiftieth day. It is most marked on the chest and belly."

The old epidermis is succeeded by one of new formation. Sometimes, in the axilla, the new epidermis is still imperfect whilst the shreds of the old are being cast. Thus there results at times an oozing, or even a true intertrigo. Depaul has observed eases in which desquamation began before birth. These cases must not be confounded with those of maceration of the epidermis of dead children in the liquor amnii.

Cutaneous excretion. The epidermic desquamation is in relation with the new functions which the skin has to perform. Perspiration, hitherto wanting, is about to be established. The sweat-glands are but little developed. But oecasionally newborn infants wrapped in cotton-wool perspire pretty freely.

Bouchaud estimates at 55 grammes in twenty-four hours the transpiration of an infant after the eighth day.

The lacteal secretion in the new-born. A phenomenon is occasionally seen to which nurses, especially the more ignorant, attach great importance—the formation of milk in the breasts. Natalis and Gubler consider this as a constant and normal process. It is usually established about the fourth to the tenth day. De Sinéty 1 has carefully studied the subject. The breasts swell, sometimes become red—that is, the glands inflame, and abscesses may result. According to our observations, this result is commonly due to the meddling of the nurse, who thinks the milk ought to be squeezed out. But in normal cases slight pressure will bring out a little oozing from the nipple, which has all the appearance of milk from the adult. This may last for a month or more. It is observed in both sexes alike.

Chemical analysis of this milk, ealled by the Germans 'Hexenmilch' (witches' milk), has been made by Quevenne (see Gubler²). It is shown that this liquid contains all the principal substances of woman's milk—butter, caseine, sugar of

¹ Recherches sur la mamelle des enfants nouveau-nés. Arch. Physiologiques, 1875.

³ Société de Biologie, 2ème Série, t. II.

milk. It shows ephithelial cells in fatty degeneration, fatglobules. De Sinéty says the epithelium cells appear first and correspond to the colostrum period, and that the fat-globules appear next and correspond to the secretion of true milk.

Increase of weight. The new-born commonly loses weight during the first two or three days, or until it gets a fair supply of food. What is the standard weight of a child? It is difficult to state it. Healthy children, at term, range from $6\frac{1}{2}$ lbs. to 8 or 9lbs. But cases are met with in which lesser and greater weights are noted. New-born children below $6\frac{1}{2}$ lbs. may be reasonably suspected of being premature. On the other hand, it is difficult to assign a maximum weight—10lbs. is the weight of a very large child; 12lbs. make a little giant; and Robert Barnes weighed a new-born infant which turned the scale at $17\frac{1}{2}$ lbs.; it was still-born.

Boys weigh, on an average, more than girls. The weight also varies with race. Our American cousins contend that they produce the biggest children.

The loss of weight on the first day is due mainly to the discharge of meconium and urine and to pulmonary and cutaneous exhalation. On the second day the pulmonary and cutaneous exhalation may be even greater, but there is a further loss by absorption of fat. This continues until food is adequately assimilated. Then the child begins to gain weight. We believe that it has commonly regained the weight it had at birth at the end of a week. The children of pluriparæ generally pick up more quickly than those of primiparæ, because the first secrete milk more readily. Tarnier says children given to nurse by a woman whose milk secretion is established grow at first more quickly than if nursed by their mother, whose milk is in course of evolution. Ribemont-Dessaignes says the delayed ligature of the cord favours the rapid growth of the child, and ought for this, amongst other reasons, to be preferred to the immediate ligature.

TABLE SHOWING THE DAILY GROWTH OF THE NEW-BORN (TARNIER). SCALE, GRAMMES.

Month	Bouchaud	Bowditch	Albrecht	Heiseh- mann	Biedert	Mean	
	Gram.	Gram.	Gram.	Gram.	Gram.	Grain.	
1	25	35	30	35	28	30.6	
} 2	23	32	29	32	39	31.0	
3	22	28	29	28	30	27.4	
4	20	22	24	22	24	22.4	
5	18	18	20	18	16	18.0	
6	17	14	18	14	11	14.8	
7	15	12	14	12	11	12.8	
8	13	10	11	10	13	11:4	
9	12	10	11	10	12	11.0	
10	10	9	9	9	5	8.4	
11	8	8	8	8	5	7.4	
12	6	6	7	6	3	5.6	

Looking at the last column of means, especially, it is seen that the daily gain lessens every month until the end of the first year. Practically, it is enough to know that a child ought to gain from 30 to 20 grammes daily during the first four months, 20 to 10 during the succeeding four months, and 10 to 5 during the concluding four months of the year.

These figures are important. If the gain falls much below the *minima*, something is wrong with the child, its food, or the care taken of it.

A child in good health, well fed, and properly tended, grows rapidly; its gain from day to day is perceptible to the eye; its figure is plump; its body firm; its skin is full; its buttocks prominent, firm, and studded with little hollows or pits; the skin in this region is red, almost violet, mottled.

In France the balance is greatly resorted to as giving precise indications of the condition of the child. The weighings should be made weekly when the child is apparently healthy; daily when it shows signs of falling off. Allowance must be made for loss by evacuations. The weights may usefully be recorded on charts similar to those used for temperature-records. The trial by weight is often appealed to in medico-legal investigations.

Growth of child in size. Quételet (1833) found the mean growth in stature was 40 millimetres in the first month, 30 in the second, 20 in the third, and from 10 to 15 in each of the succeeding months. Bouchaud arrived at nearly identical results.

GROWTH IN STATURE.—TABLE AFTER TARNIER.

During the 1st month				. 40 millime	etres.
,, 2nd ,,				. 30 ,,	
" 3rd "				. 20 ,,	
Each succeeding month	ı .			10 to 15 ,,	
Of the 1st year				. 198 "	
" 2nd "					
" 3rd "				. 73 ,,	
During each of next tw	o year	rs		. 64 ,,	

This growth is not evenly distributed over the body. The head, which is relatively large at birth, grows more slowly in proportion to the limbs.

Modifications of the sutures and fontanelles. In the healthy new-born the sutures and fontanelles enlarge at first, and lessen when the child is the subject of athrepsy. According to Elsaesser, the width of the greater fontanelle at birth averages 21.6mm., and reaches 31.3mm. at the ninth month. From this time it contracts, and in the second or third year it disappears, except in rachitic or hydrocephalic children. Sappey says the posterior and lateral fontanelles are obliterated in the first year.

Observation of the fontanelles supplies valuable clinical indications. If there is marked depression mal-nutrition may be suspected. If, on the other hand, the brain rises fairly to the due level, the child is fairly nourished.

Care of the New-born Child.

As soon as the child is expelled from the vagina, any coils of cord round its neck or body should be untwisted. The attendant having then placed the child close to the mother, so as to avoid any strain on the cord, should cleanse its mouth from any fluids, such as blood and mucus, it may have partially swallowed during its passage through the vagina. This should be done at once, as such fluids drawn into the lung vesicles may give rise to inflammation of the lungs, or even septicæmia.

When the child has cried out freely, the umbilical cord may be divided and the child wrapped in flannel and entrusted to a nurse. The cord is ligatured with stout thread in two places; the first about two or three inches from the umbilicus, the second two or three inches beyond the first spot. It is then divided between the two ligatures. Nearly all obstetricians now wait for a few minutes after the birth of the child, until the pulsations in the cord have slowed down and become feeble, before proceeding to tie it. Budin and Ribemont-Dessaignes have shown by experiments that ligature of the cord immediately after birth deprives the child of a considerable quantity of blood which it derives from the placenta as long as the pulsations in the umbilical cord are distinct. It is usual to wrap the child in a warm blanket and place it on the bed or sofa, until the binder has been applied to the mother and the drawsheet has been removed. This being done, the child should be washed from head to foot in warm water. In giving the child its first bath it is not necessary to endeavour to rub off all the vernix caseosa. If soap is freely used, what remains will disappear at the second or third bath.

As soon as the child has been dried, the part of the cord which has been left attached to the umbilicus is wrapped in a piece of clean, dry linen, lightly charred, and a belly-band is then wrapped round the child's abdomen.

When the child is dressed it may either have one or two teaspoonfuls of warm sugar and water, or it may be placed, if the mother intends suckling, to the breast. The new-born child requires external warmth, and it is especially necessary during the first days of its extra-uterine life to keep it warm and protected from draughts. In weakly children the temperature has been observed to fall as low as 33° C. in half-anhour after birth. This indicates the small amount of intrinsic heat in the new-born child.

The clothing should be light and warm, and at the same time not so tight as to restrain the free natural movements of the child. It is well to avoid tight bandages round the abdomen; they impede the due descent of the diaphragm, and thus prevent the lower air vesicles receiving their full complement of air. In cases of umbilical hernia, where the use of a pad is necessary, a somewhat constricted bandage is necessary. It is better that all the clothes should be made to fasten with strings instead of pins. If pins must needs be used, let them be of the kind known as 'safety pins.' The arms, shoulders, and legs should be covered. The napkins which it is usual

to wrap between the buttocks for the reception of the child's excrements should be changed immediately they are soiled either by fæces or urine. Neglect of this act of cleanliness results in excoriations and cruptions of the skin, which wear the child's nervous energy and lower the state of its health. It is a good thing to see that the temperature of the child is normal from time to time. If, for instance, the temperature is found to be sub-normal for several days in succession, it is probable that it is not sufficiently warmly clad. Clothing should then be added until the normal temperature is reached.

The causes and prevention of Ophthalmia. Of late years a practice has been strenuously urged and extensively practised of applying nitrate of silver to the eyes soon after birth, with the view of preventing ophthalmia. The practice is based upon the hypothesis that ophthalmia is caused by the infant's eyes coming in contact with irritating discharges, whilst in transit through the vagina. It is further assumed that generally, if not always, the offending matter is gonorrheal. That this hypothesis is true in a certain proportion of cases we have no doubt. But that it is exclusively, or even in most cases, true we do not believe. We have assisted at the labour of a lady who, we were able to say positively, was free from all unhealthy discharge; the child was, moreover, born in the unruptured bag of membranes, the ovum, placenta and all, being expelled entire. The child was taken out of the sac by clean hands. Neither our hands nor the child ever came in contact with the mother's parts. Yet four days afterwards ophthalmia appeared. Again, cases have been reported of ophthalmia in children delivered by Cæsarian section. The real source of mischief is not far to seek. It is found in the use of sponges and towels that have not been properly cleansed. 'Things from the wash' are a fruitful source of danger to the child as well as to the mother. The sponges used for the child should be scrupulously disinfected, and towels for washing as well as the diapers should be washed at home, or disinfected before being used. If care in this respect be rigorously observed, and if the nurse will disinfect her hands after attending to the pucrpera, we are convinced that ophthalmia will be extremely rare, and that the barbarous plan of indiscriminately swabbing the child's eyes with caustic may be discarded.

Erysipelas, starting from the navel, may in many cases be suspected to have been communicated by the foul sponges or other modes of contact with infection.

Milk as affected by the Food and Medicines taken by the Mother.

1. Milk as affected by food. As a general fact, it is true that there is a certain relation between the food taken and the quantity and quality of the milk produced. This is well understood in the case of cows. The milk produced by cows kept in stalls and fed chiefly on brewers' grains, a process which seems to stimulate the secretion from the breasts, is certainly inferior in quality to that yielded by cows fed on hay or grass in the country.

Somewhat analogous to the stimulation of milk in cows by brewers' grains is the stimulation of the secretion in women by drinking stout. It is a wide-spread belief in this country that nursing women require an abundant supply of stout. It is certain that many women thrive upon it, and keep up their supply of milk. But many others are injuriously affected by it. Perhaps they take too much, absolutely and relatively. Women accustomed to hard work may digest one or two quarts of stout a day, and yield good milk. Others will do better on a single pint. In every case it is desirable to regulate the allowance, strictly beginning with the smallest quantity that can be used with advantage. And it must not be forgotten that some English women, and most women of other nations, nurse well without any stout. Women accustomed to wine may take that to which they have been accustomed, carefully observing moderation.

A decisive objection against any excess in alcoholic drinks by nursing women is that the child is likely to be injuriously affected. Alcohol passes into the milk. 'Ebrii gignunt ebrios.'

The simpler the diet of the nursing woman the better. Plainly dressed mutton, beef, poultry, fish, light combinations of butter, eggs, and milk, bread and other farinaceous articles should form the staple. She generally requires more fluid than in the ordinary state. This unusual demand is best met by

milk, water, plain or aërated. Tea and coffec should be taken in moderation, and not strong. Cocoa is at times useful.

The nursing woman should take regular exercise in the open air when possible. She should avoid chills, and be guarded against mental perturbations. No one secretion can well go wrong without entailing disorder in the rest. Therefore care should be taken to regulate the action of the bowels, preferring some mild aperient, as the compound liquorice powder, or the Hunyadi-Janos, Friedrickshall or Æsculap waters.

Should the woman show symptoms of acute or chronic dyspepsia, the milk is sure to be charged with some of the products of badly-digested food; and the child will be likely to suffer. Pains in the stomach from colic, evinced by drawing up the legs, tension of the abdominal muscles, crying, vomiting and diarrhæa, the stools being greenish and curdled, are sure signs of its food disagreeing. In such a case treatment must be directed to the mother as well as to the child. And in this treatment temporary lowering of the diet, especially of stimulants, is the most essential point.

2. Milk as affected by medicines. All medicines probably, taken in physiological or poisonous doses by the mother, pass into the milk, and may affect the infant at the breast. Robert Barnes has detected iodine in the milk when given to the mother. Thus given, a syphilitic suckling may be cured. Quinine, so useful to the mother, has sometimes to be given up because it gripes the child; and so it is with colocynth.

It is possible that doses that act only physiologically on the mother may act poisonously on the more susceptible organisation of her nursling. This applies more especially to the convulsive and narcotic poisons.

The Choice of a Wet-Nurse.

Trousscau especially insisted—

1. That a nurse should already have reared one child. A cow at the third calving gives more milk. A woman who has previously suckled is likely to have better developed breasts. When phlegmon of the breasts has previously occurred, it may be presumed that a part of the gland has suffered in its texture, and that a repetition of the abscess may occur in future

lactations. Whereas, if a woman have suckled one or two children without mischance, she may be considered safe. She may, in short, be held to have proved her bodily soundness by this capacity for lactation, the final act in the process of generation.

2. The nurse should have been delivered six or eight weeks, because fissures and the consequent inflammations mostly declare themselves before this time.

In selecting a wet-nurse the examining physician has the following additional points to bear in mind: When was her last confinement? who attended her? Has he any previous knowledge of her health or habits? To make a careful physical examination of the nurse and her baby. To verify the amount of milk in both breasts. To determine its quality. To look for evidences of consumption, or scrofula, as well as signs of syphilis, such as primary sores, mucous patches, enlarged glands, loss of hair, Hutchinson's teeth. Lastly, is her health, in all respects, such as would fit her for wet nursing, and is her baby healthy? Natalis Guillot estimates that a nursling draws from the breast an ounce and a half or two ounces during the first month, eight to ten ounces during the third month, thirteen to fourteen when twelve months old. These estimates were deduced from weighings of the child. The method is not free from fallacy. The quantity allotted to the first month is certainly underrated.

Substitutes for Breast Milk.

A good substitute is asses' milk. This can be given with only slight dilution. Cows' milk comes next; this must be diluted with one third part of warm lime-water and slightly sweetened.

Great care is necessary in having it drawn twice a day, and keeping it in a cool place, or in ice, covered over. Where it cannot be had in fresh supplies at short intervals, it is necessary to heat the milk to near the point of boiling. Perhaps, however, the nearest approach to human milk is the condensed mares' milk, as introduced by Dr. Carrick. It is, indeed, almost identical in its constituents with human milk. For several years past it has been extensively used with good results in the foundling hospitals at St. Petersburg and Moscow.

Fancourt Barnes has also employed it in his wards in the British Lying-in Hospital, and has found it answer in a very satisfactory manner.

Next to the fresh milks come the various forms of prepared milk. Of these that in most general use is the Swiss prepared milk.

There is no substitute for milk. It is the only all-sufficient food. It therefore forms the staple of all the artificial foods for infants which are of real value.

The differences between colostrum and milk are that in colostrum the corpuscles cannot mix intimately with the serum, whilst in milk the fatty droplets form a true emulsion in the serum. Moreover, colostrum coagulates in boiling, which proves that it contains albumen, whilst milk does not possess this property, because the albumen has been transformed into caseine.

The chemical constitution of milk. According to the analyses of Becquerel and Vernois, milk contains, in 1,000 parts, 889 of water and 111 of solid matter, of which 39:24 are caseine, 26:66 butter, 43:64 sugar of milk, and 1:38 inorganic salts, amongst which is phosphate of lime.

The specific gravity varies a little.

The reaction is alkaline.

Asphyxia Neo-natorum.

The first point of intcrest in the new-born child is to determine whether it be alive; the next is to determine the prospect of its thriving. In the great majority of cases, all doubt upon these points is quickly removed by the child's crying vigorously and moving its limbs. But in some cases these evidences of robust life are wanting or delayed.

In some of these latter cases the child is really dead—still-born. In others animation is suspended. It is of instant importance to verify these conditions, in order that proper measures may be promptly taken to nurse, sustain, and establish the flickering flame of life. 'Latet scintillula forsan' was Marshall Hall's favourite motto. Let it be ours; it is the most hope-inspiring stimulus to endeavour to rescue a life trembling in the balance.

What constitutes Live-Birth? The question seems to carry its answer. But in practice the answer is not always easy. The question is of extreme importance in its forensic relations. For example, infanticide cannot be committed upon a still-born infant. A still-born infant is buried under different regulations from a live-born one.

There are several tests of live-birth. Live-birth is proved by the existence of any of the known functions of life; as movements depending upon nervous and muscular action, the pulsation of the heart, and respiration. It is obvious that any one of these movements is a vital act. Respiration may be wanting, but the pulsation of the heart may continue for some time, and so long as it lasts it offers presumptive evidence of such life in the nervous centres as may be appealed to with the view of full restoration. The heart may practically be regarded as the 'ultimum moriens.' The heart of the frog, for example, may continue to beat for some minutes after removal from the body. It might be argued from this fact that it possesses an independent vis insita. But this must be of short duration.

A stronger proof is the establishment of respiration. This test has a certain practical convenience. When breathing takes place the evidence of life is manifest and incontestable. It bears, moreover, evidence of its accomplishment after death in the condition of the lungs and of the chest-walls. A strong objection to accepting this as the only absolute test lies in the fact that respiration is frequently started spontaneously, or under treatment, after many minutes, even half-an-hour after birth; the only evidence of life up to this moment being the beating of the heart. Now to accept breathing as the only test would entail this dangerous conclusion, that if the infant be strangled, so as to prevent its breathing, there is no murder. The law accepts any distinct evidence of life; and to destroy even an immature and non-viable child which gives evidence of life is infanticide.

It is obvious, however, that life, even latent, cannot long be sustained unless respiration be established. The failure to breathe induces asphyxia.

We may recognise three forms of asphyxia:

A. Simple asphyxia. This may be defined or described as the state arising from interrupted hæmatosis or the arrest of the placental respiration before the establishment of lung respiration.

B. Paralytic asphyxia. In this case respiration is prevented by incapacity of the nervous centres.

C. The asphyxia of imperfect development, or atelectasis.

A. Simple asphyxia. The chief causes of this form are:
1. Those arising before birth, or active labour, as: complete or considerable separation of the placenta; unintermittent uterine contractions from ergot; cyanosis or feeble hæmatosis of the mother, from disease, hæmorrhage, or the moribund state.
2. During birth. In addition to those cases enumerated above, compression of the placenta, knotting or compression of the cord, as in prolapsus of the cord, twisting of the cord round the child's neck or body. The child's neck may also be compressed by the tight ring of the vulva retracting upon it when the head has passed. When this occurs the blood is prevented from returning from the head. The face becomes bloated, cyanosed; the child is in danger of being strangled.

Asphyxia of this kind is marked by lividity of the face, and perhaps of the body as well. It may be distinguished briefly

as cyanotic or blue asphyxia.

B. Paralytic asphyxia is produced by compression or other injury to the brain and medulla oblongata. This is especially apt to occur in labour with disproportion, under delivery by forceps or by turning. Syncope has been invoked to explain some of these cases.

In some of the fatal cases we find lesion of the brain, meningeal effusions of blood, or at least congestion of the pons varolii and medulla oblongata. In such cases the face and skin generally are pale, the limbs are flaceid, there is muscular paralysis. These two forms may be recognised as pale asphyxia.

C. In the asphyxia of defective development the air-cells are not developed; there is atelectasis, and corresponding defects of the heart. This is the condition of premature and non-viable children. But it is occasionally observed in children

at term.

The symptoms, diagnosis, and treatment of Λ . There is cyanosis or blueness and turgidity of the face and skin generally; flagging of the heart's action; twitching of the

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limbs in inspiratory efforts; sneking-in of eircumambient fluids; perhaps evacuation of meconium and urine. If respiration is established, the cyanosis clears off, the skin becomes rosy, the infant opens its eyes. In vol. i., p. 552, we have related experimental observations in proof of the equivalence of placental and aërial respiration. The arrest of either kind of respiration entails like effects. Thus, Hecker, Krahmer, Sehwartz, and others prove that where placental respiration is impeded, a spontaneous attempt by reflex action is made to substitute aërial respiration. Hüter relates a case (1856) in which the fœtus breathed and cried in an unbroken ovum. We find evidence of this attempt in the presence of liquor amnii, of feetal epithelial seales, and meconium in the air-passages; and also in the appearance of eechymoses or puncta of blood under the pleura and pericardium. This effort is the result of the accumulation of earbonic acid in the blood. There is an instant want of oxygen, and the inspiratory act is excited to supply it. Our observations already referred to (vol. i., p. 552) prove the direct influence of respiration, whether placental or aërial, in keeping up the heart's action. Brodie long ago demonstrated that artificial respiration will keep up the heart's action in the adult animal. We have it then clearly established: (1) that the utcrine contractions of labour, whether occurring spontaneously or artificially produced, lower the heart's action; (2) that placental or aërial respiration raises and sustains the heart's action; and (3) that, unless aërial respiration be kept np in the new-born child, the heart's action will speedily fail altogether. Here, then, we find the scientific basis for resorting to artificial respiration when natural respiration cannot be provoked.

Treatment. In the greater number of cases there is no clogging of the air-passages; there seems simply to be delay in effecting the first inspiration. The problem then is: how to start it. A main factor in producing the first inspiration we believe to be the expansion of the chest by resilition on the sudden liberation of the chest from compression as it emerges from the pelvie outlet; another is the besoin de respirer, produced by accumulation of carbonic acid in the blood, as the placental respiration is impeded in the final expulsive contractions of the uterus; a third is the diastaltic action excited by

the contact of air and attendant evaporation of moisture on the skin of the face and chest. These give the indications for treatment. We may first appeal to the diastaltic function. 1. Blow upon the face; dash a little cold water on the face and chest; sprinkle a little brandy or other spirit on the chest, using gentle friction; flick the chest and buttocks with the corner of a wet towel; dip the child for a moment in water at 90° F. or nearly.

2. Reflex irritation failing, turn to artificial respiration. There are two principal methods:—a. Direct insufflation into the lungs; b. Expanding the chest-walls to create a vacuum, which draws air into the lungs. The first method is the most ancient. It was first practised by blowing from mouth to mouth, with or without the intervention of a piece of gauze. It was found that the air often passed over the trachea and went into the stomach. A tube was then resorted to, which was passed into the trachea, and served for insufflation. Two points have to be met. First, the surgeon should fill and empty his lungs several times deeply, so as to lessen the charge of carbonic acid in the air he is about to insufflate; and. secondly, insufflate very gently, lest the delicate air-vessels be burst. Several instruments compete for selection. In the 'Obstetric Operations' we figured Richardson's apparatus. It consists of a double bellows of indiarubber uniting into one tube, at the end of which is a nozzle, which is introduced into one nostril of the child. The other nostril is then closed. Valves are so arranged that one ball acts for insufflation, the other for expiration. If it be feared that the air may not go into the lungs, you may compress the other nostril. Both balls are compressed simultaneously. Air is taken up by one and goes into the lungs; it returns by the ball which exerts a suction-action. Two things are important in working the apparatus: one, that the air be warm and dry; the other is, not to exert too much force. But Richardson insists that, if one nostril be left free, the air returning easily, undue pressure upon the vesicles is avoided. Our own experience with the apparatus is satisfactory.

Some form of tracheal tube has long been known. A tracheal tube was at one time a common companion of the obstetrist. The delicate air-vesicles are easily burst under insufflation;

hence the necessity for extreme care in introducing air by the tube. The best insufflator appears to us to be Ribemont-Dessaignes'.

The laryngeal end is conical, and thus adapts itself to the cavity of the larynx and prevents regurgitation of the insufflated air. In introducing the instrument, the left index is passed into the pharynx until it is behind the glottis; the instrument, held like a pen in the right hand, is then passed along the middle of the mouth until it reaches the bulb of the finger behind the glottis; the part of the instrument which remains outside the mouth is then slightly raised and the larynx is entered. The operator feels when the tube has entered far enough by the resistance opposed by the larynx, which fits closely round the upper part of the cone. The operation is best done with the child lying on its back. When

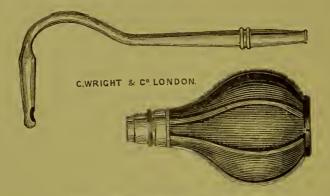


Fig. 8.—Ribemont-Dessaignes' Insufflator.

the instrument is introduced it is best to aspirate at first any fluids in the trachea. This is done by first emptying the ball of air and then allowing it to refill itself from the larynx. The great advantage of Ribemont-Dessaignes' model over other forms is, that its laryngeal end coincides with the anatomical curves of the mouth and air-tubes, which it thus accurately fits without violence or injury.

The methods based upon turning to account the elasticity of the chest-walls, so as to produce a vacuum, and thus to suck in air, have one supreme advantage—they require no apparatus. The surgeon trusts to his hands alone. These methods deserve in an especial manner the title of natural or 'ready' methods.

As we have pointed out, an efficient cause of the first inspiration is the sudden release of the chest-walls from compression as the chest emerges from the vulva. The instant effect is the expansion of the chest and the creation of a vacuum, inducing an indraught of air. This series of phenomena is imitated in the methods of artificial respiration known as Marshall Hall's, Sylvester's, Howard's, Pacini's, and Bain's.

1. Marshall Hall called his the 'ready method.' It is

1. Marshall Hall called his the 'ready method.' It is effected in this way:—Lay the child on its back, the head slightly raised; then roll the trunk over a little more than a quarter; turn on its side, until the chest looks a little downwards; then roll the trunk back to its original position; repeat this movement twelve to sixteen times a minute. The weight of the trunk upon the chest compresses it, and the elasticity of the chest opens it when the weight is taken off, and air is drawn in. Presently, if success is to attend, the stimulus of air in the lungs sets the heart going more fully, and spontaneous breathing is gradually or quickly established. Children have been restored by this and the other natural methods after half-an-hour or even more.

Conditions essential alike to all the methods are, first, that the surrounding air be warm and dry; secondly, that the child's legs and trunk and head be protected from cold as much as possible by wrapping in warm, dry flannel.

- 2. Sylvester's method. Place the child on its back, the head slightly elevated; seize the hands or fore-arms, one in each of your hands, and extending them outwards so as to bring the child's hands above the level of its head; then bring the arms down again to its sides; repeat this manœuvre twelve to sixteen times a minute. The chest is thus pulled open by the attachments of the pectoral muscles, and it collapses again when the arms come down.
- 3. Howard's method. As we have seen Howard demonstrate it, the child is held on its back in the operator's left arm, the head hanging down a little; this attitude opens the larynx; then with the right hand the chest-walls and abdomen are alternately compressed and relaxed twelve to sixteen times in the minute.
- 4. Pacini's method. Place the child upon its back, and, standing behind its head, insert your hands in the axillæ on the

dorsal aspect; then pull the shoulders towards you with an upward movement; then let them fall again. This is repeated twelve to sixteen times in the minute,

- 5. Bain's method is a modification of Sylvester's and Pacini's. The child lying on its back, place your fingers in its axillæ in their front aspect, with your thumbs over the outer ends of the clavicles, and draw the shoulders towards you. On relaxing your hold, the shoulders return to their former position.
- 6. Another method more commonly practised is to seize the child's arms, lift them up and from the sides so as to pull open the chest; then bringing them to the sides, compress the chest with your hands; then repeating the manœuvre, the natural elasticity of the chest is aided by the pulling-open movement by the arms.

We need only mention Schultze's method of swinging and tossing the child. It has not been shown to possess any advantage to compensate for the violence which characterises it.

Appreciation of these methods. We have tried all these methods excepting Schultze's. Under each asphyxiated children have recovered. Under Marshall Hall's plan the rolling about of the child's head is awkward; but it has this advantage, insisted upon by Dr. Bowles, the most authoritative exponent of Marshall Hall's views, of permitting the escape of fluids from Sylvester's and Bain's methods are more easily the lungs. practised on the infant. Bain's and Sylvester's were admitted by a Committee of the Medical and Chirurgical Society, on which C. J. B. Williams, Brown-Séquard, Dr. Burdon-Sanderson and Mr. Savory served, to draw in more air than Hall's or Pacini's. We believe Howard's to be of equal efficacy. The experiments made by this Committee were upon animals and dead adult men. But the results obtained by Dr. Champneys upon still-born infants led to similar conclusions (Med.-Chir. Transactions, 1883). These laboratory experiments are not without value; but it would be unsafe to accept them as complete simulacra of like experiments upon infants apparently still-born. Apart from the great fact that in these last there exists in the vital spark a factor which is absent in the dead, there is the further fact that the chest-walls quickly lose after death a part of that resiliency which is a main active factor in the living. A drawback common to all the methods, but in a less

degree to Bain's, Howard's, and No. 6, is the protracted disturbance of the child. We have seen reason to conclude that in some cases the extensive movements did more harm than good; they constitute a kind of violence entailing shock; they may thus help to extinguish the latent scintillula, which gentle treatment might have fanned into life. Dr. Bowles points out that the plans, which are based upon the assumption that the chest-walls are expanded by pulling upon the arms, cannot be depended upon. The pectoral muscles really exert but slight traction upon the chest. We conclude that Hall's and Howard's method, separately or combined, are best.

We have, however, become less sanguine as to the value of these methods. Where means of exciting reflex action failed, we have thought it best not to persevere too long with these artificial methods, but to wrap the infant in a warm flannel and get it nursed before the fire. In this way, by apparent inaction—deliberate, if not masterly—the flickering spark will sometimes gather strength, and respiration will be established. Not seldom have the attendants been surprised to hear a child cry which had been laid aside as hopelessly gone. But lookers-on are rarely competent to appreciate inaction. Inaction may be the best course, but it bears the outward likeness of neglect. Many a man has earned high credit for strenuous exertions which were really injurious.

In the cases of strangling by the cord round the child's neck or by the retracting vulva, it is useful, before tying the cord, to let a teaspoonful of blood escape from it. It is one of the most remarkable and gratifying illustrations of the phenomena of respiration and circulation to see how quickly the bloated, cyanoscd aspect of the face vanishes, giving place to a healthy, roseate hue, when a good respiration is established. A vigorous cry accomplishes a great physiological purpose. It rapidly propels aërated blood throughout the entire system; all the capillaries are instantly permeated, and so the nervous centres receive the necessary stimulus.

Marshall Hall insisted forcibly upon 'secondary asphyxia' —that is, after successful institution of respiration and apparent dispersion of the primary asphyxia, there might still persist an undue proportion of carbonic acid in the blood, which would gradually increase and ultimately culminate in the return of

deep, perhaps fatal, asphyxia. Hence the necessity for continuous watching of the subjects of artificial respiration. The subsequent care is of the greatest importance. If the child have cried lustily, there is not much fear of relapse. But it is always advisable to wrap it carefully in warm, dry flannel, to nurse it before the fire that it may breathe warm dry air, and to use occasional frictions of the chest.

The couveuse. In 1881 Tarnier introduced into the Maternité an apparatus designed to sustain the animal heat of delicate new-born infants. It consists of two compartments: a lower one, containing hot water, so constructed as to maintain a uniform temperature; and an upper, which contains the child's cradle. The hot-water compartment warms a current of air which warms the child's compartment. The standard temperature is about 34° C. Modifications of this apparatus, adapted by Budin, consist in a warning bell, which tells when the temperature is too high or too low, and indicates the need of regulation.

The value of this contrivance has been very marked in cyanosis simple, in cyanosis with cedema, athrepsia, syphilis, depression after severe labour, as in delivery by forceps, and prematurity. During their stay in the *couveuse* the children are fed with asses' milk by the spoon; all feeding-bottles or biberons are interdicted in the Maternité.

Observations prove that the pulse, temperature, and respiration are improved under the treatment.

Led by an analogous idea, Winckel tried the effect of prolonged baths, the child being immersed in the water. The observations are scarcely numerous enough to warrant clear conclusions; but we may appeal to all swimmers for testimony to the fact that the respiratory movements are performed with less freedom when the chest and abdoinen are immersed in water.

Atelectasis is that condition in which the lungs, either from imperfect development or from want of penetration by air, retain partially their feetal condition. The air-vesicles do not open; certain lobes—perhaps chiefly the inferior—and the edges remain solid. This occurs especially in premature children,

¹ De la Couveuse pour Enfants. A. Auvard. 1883.

but sometimes it is observed in infants born at term in a state of athrepsy. It is also noticed in some cases in which respiration is not attended by that loud cry by which the new-born babe announces his arrival, and carries joy to the heart of the mother.

The breathing in atelectasis is characteristic. The inspirations are short, incomplete, and the effort, instead of expanding the lungs and arching the chest, seems to draw in the chestwalls concentrically. The result is that the ribs on either side of the sternum are flattened, or even curved inwards, as if seeking the spinal column.

We here interpolate a note on the remote effects of asphyxia.

Dr. Little in a most suggestive memoir ¹ 'On the influence of abnormal parturition, difficult labours, premature birth, and asphyxia neo-natorum on the mental and physical condition of the child, especially in relation to deformities,' adduces clinical evidence in support of the proposition that spastic rigidity of of the limbs, leading to deformities, may be caused by difficult labour.

Dr. Crichton Browne ² is one of the few observers who have traced idiocy to difficult labour.

The hæmorrhages of the new-born. The chief seat of hæmorrhage is the umbilicus.

Hæmorrhages from the umbilicus are not frequent. The physiological diversion of the current from the hypogastric arteries offers a natural security. Still, it occasionally happens that, the ligature being badly applied, or becoming loose from the shrinking of the connective tissue of the cord, hæmorrhage breaks out after the child is dressed; and in this way the child may bleed to death before the cause is detected. In such a case, if the source be discovered in time, another ligature applied may be effective. But we have known serious bleeding take place from the umbilicus itself on the fall of the cord. In such a case we have secured the bleeding vessels by passing two needles at right angles to each other through the abdominal walls so as to get below the bleeding spot, and then twisting a fine silk ligature round the needles.

¹ Obst. Tr. 1862.

² 'Psychical Diseases of Early Life,' Journal of Mental Sc., 1860.

Plouequet, Baudeloeque, and others showed that by interrupting the respiration there arose a disposition to umbilical hæmorrhage. The arterial tension being increased, and the physiological diversion of the circulation being disturbed, the current would be stronger towards the umbilical vessels.

Hæmorrhage from the umbilieus or cord may be suspected if the child becomes suddenly or rapidly very pale and cold. In such circumstances not a moment should be lost in undress-

ing the child for complete inspection.

Ribemont-Dessaignes (Les Hémorrhagies chez le Nou-veau-né, 1880) collects several cases of hæmorrhage from the stomach and intestines; he also gives a table, from various sources, of hæmorrhage from the vulva.

In many cases the hæmorrhage is due to a grave dyserasia. The quality of the blood is deeply impaired. In some cases, perhaps in most, the cause is hereditary. One of these conditions is hæmophilia. But it is not the most frequent. The influence of syphilis is ill-defined. Weber (of Kiel) thinks that the jaundice which so often attends the dyserasic hæmorrhages of the new-born is connected in syphilitic eases with a specific lesion of the hepatic parenehyma. But Parrot affirms that true ieterus is very rare in syphilitic children. Lancereaux relates a case in which liver and spleen were affected by syphilitic taint, and led to fatal omphalorrhagia. The association, however, of jaundiee with hæmorrhages has been frequently observed. The dyserasic conditions which lead to hæmorrhage from the umbilicus may also lead to hæmorrhage from other parts, especially the intestines.

Athrepsia is a frequent morbid state in the new-born. The term was proposed by Parrot to express a condition resulting from any of the causes which impair nutrition: as physical causes, such as malformation of the child's mouth or of the nurse's breast, insufficiency of milk; morbid causes, as erysipelas, ædema, congenital debility, sometimes syphilitic, peritonitis, eruptive fevers, and so on.

Athrepsia is not seldom attended by hæmorrhage. An alteration of the blood appears to be the first condition. The hæmorrhage may take place into any of the internal organs.

Traumatic hamorrhages. These may be internal, the result of injuries received during labour. Of course, an accidental

wound, as from a pin, may be inflicted after birth. It has happened from the wound in vaccination; from that operation so often performed unneccessarily, cutting the frænum linguæ; and from circumcision. In such cases the bleeding may be stopped by actual cautery, or nitrate of silver.

CHAPTER IV.

THE FACTORS OF LABOUR.

DEFINITIONS—DIAGNOSIS OF PRESENTATIONS AND POSITIONS—
STRUCTURE AND COMPONENT PARTS OF FŒTAL HEAD—DIAMETERS—PROPERTIES OF FŒTAL HEAD—MOULDING—FRACTURE
—CHEST—TRUNK—BREECH—PLASTIC PHENOMENA—CAPUT
SUCCEDANEUM—CEPHALHÆMATOMA—THE MECHANISM OF LABOUR: HEAD; FACE; OBLIQUE OR TRANSVERSE—SPONTANEOUS
VERSION—SPONTANEOUS EXPULSION—TWINS—TRIPLETS.

In describing the mechanism of labour the following terms are used—*Presentation*, *Position*, *Vertex*. It is necessary to attach a definite meaning to these terms.

1. The obstetrical definition of Presentation is that part of the child or ovum which presents at the pelvic brim and os uteri. Thus when the head engages first in the brim or eervix uteri, it is said that there is a 'head-presentation.'

Presentations are Natural or Preternatural.

According to Naegele, those presentations are natural in which the long axis of the child nearly coincides with the axis of the pelvis. Under this definition will fall the presentations of the head and breech or pelvic extremity.

Those presentations are preternatural in which the long axis of the child does not nearly coincide with the axis of the pelvis. Under this head fall trunk and shoulder presentations. These are also called transverse or oblique presentations, and, vulgarly, cross-births.

A characteristic of the natural or head and breech presentations is that labour can be completed in them by the natural powers. On the other hand, in the preternatural or transverse presentations, the presentation must almost always be changed by nature or art before labour can be carried out.

- 2. The position means the relation of the presenting part of the child to the diameters of the pelvis. Thus when the head presents with the occiput directed to the fore part of the pelvis, there is said to be an occipito-anterior 'position.'
- 3. The *vertex* of the head is the summit—i.e. the space between the fontanelles and the parietal protuberances.

The Diagnosis of the Presentations and Positions.

One of the first clinical problems to be solved is: What is the presentation? and secondary upon that is: What is the position?

The *head*, if presenting by the vertex, is recognised by the firm expanse of its bones, by its sutures and fontanelles, by the plasticity or overlapping capacity of the parietal bones along the sagittal suture.

The diagnosis of the several positions will be described when tracing the mechanism of labour in each position.

The Fœtus in its Obstetric Relations.

We will first describe the head. The general form of the head must be studied in the first place as it exists before labour—that is, before it has undergone compression and moulding in the parturient canal.

The general form of the head before labour approaches the spherical; but, taking in the face, there is a long diameter measured from the most prominent point of the occiput to the tip of the chin. With this it forms an ovoid.

The Structure and Component Parts of the Fætal Head.

The head is that part of the fœtus which takes the first place in obstetric interest. It is the largest and the most solid part. It is composed of two distinct parts—the cranium and the face. The face is made up of fourteen bones, two of which, the vomer and lower jaw, are single, and twelve in pairs—namely, the upper maxillary, the palatine, the nasal, the ossa unguis, the malars, and the inferior turbinate bones.

The cranium is made up of eight bones, four single and two pairs—the frontal, the occipital, the ethnoid, the sphenoid, the

two parietals, and the two temporals. The frontal at first is composed of two symmetrical halves; the sides of the cranium are made up of the parietals and the squamous portions of the temporals; the hinder part is made up of the shell of the occipital. The basis of the skull is composed of the sphenoid, the ethmoid, the petrous portion of the temporals, and the basilar portion of the occipital.

At the base the constituent bones are, if not consolidated, so far united that little mobility remains. But at the vault of the eranium the conditions are different. The bones here do not quite meet, but they are united by flexible membranes. The lines of union thus formed are called sutures and fontanelles. This disposition allows the bones to ride over each other under compression. There is also a cartilaginous hinge or groove between the shell of the occiput and its basilar portion which admits of movement.

The sutures are (1) the sagittal or antero-posterior, running from the root of the nose to the upper angle of the occipital. Anteriorly the membrane separates the two halves of the frontal

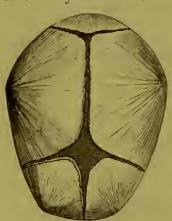


Fig. 9.—To show Sutures on Summit; Sagittal, Coronal, Lambdoidal, and Fontanelles.

bone; at the top and posteriorly it separates the two parietals. It is crossed by (2) the fronto-parietal, transverse, or coronal suture. This is situated at the union of the parietal and frontal bones. It crosses the sagittal suture, and ends on either side below at the squamous portions of the temporals. (3) The occipito-parietal or lambdoidal suture, so called from its resemblance to the Greek Λ . It is formed by the union of the posterior and lower border of the parietals with the squamous por-

tions of the temporals, and by the union of the occipital with the posterior border of the parietals. The point of the suture corresponds with the upper angle of the occipital. It might be regarded as the bifurcation of the sagittal suture.

The fontanelles are two. The name is given to the membranous spaces seated at the meeting of the sutures.

1. The anterior, the large or bregmatic fontanelle, or

simply bregma, is situated at the crossing of the sagittal and coronal sutures, which cross almost at right angles. It is lozenge-shaped, presenting four borders and four angles. The two posterior borders, shorter than the anterior, are formed by the parietals. The two anterior borders, longer, are formed by the divergence of the two halves of the frontal bone. In practice it is not unusual to find that the typical lozenge-shape as felt during labour gives the sensation of being triangular.

2. The posterior fontanelle is situated at the meeting of the lambdoidal and sagittal sutures. Strictly speaking, the bones at this point often meet so closely that a membranous space or true fontanelle can hardly be said to exist. When found it is small and triangular.

Two lateral fontanelles, or Gasser's fontanelles, are described. They are situated at the point where the lambdoidal suture

runs into the temporal suture. They can hardly be felt during labour, and are of minor obstetric interest.

Occasionally ossific centres detached from the parietals or occipital form separate bones. These are called ossa triquetra.

The occipital hinge or groove. Budin describes, under the title 'charnière occipitale,' a kind of fibrous

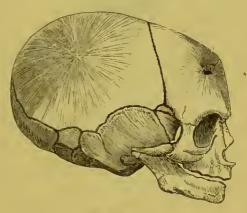


Fig. 10.—To show Head and Face in profile.

and cartilaginous hinge which allows these two bony elements of the occipital, the basilar and squamous, to execute movements of flexion and extension upon each other. This arrangement is of importance in the moulding of the head.

The articulation of the head with the vertebral column is of extreme importance, especially in relation to the operation of turning. The articulation of the occipital bone with the atlas is very close, admitting of but slight movements. The free movements of flexion and extension of the head are due to the combined action of the cervical vertebra. The junction of the cranium with the spinal column is nearer to the occiput than to the forehead. Thus the anterior arm of the lever

formed by the head is the longer. Hence, supposing resistance to be equally distributed over the cranial vault during labour, driving force transmitted along the spinal column will cause

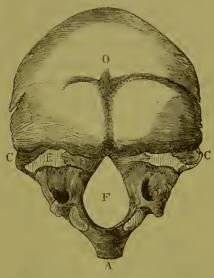


Fig. 11.—Base of Skull to show the Occipital joint. (Budin.)

A. Basilar-process of occipital bone. O. Scale of occipital. CC. Cartilaginous lamella, onter. E. Fibrous lamella. F. Foramen magnum. D. Charnière occipitale.

the occipital arm of the lever to descend. Hence the movement of flexion. The general anterior curvature of the feetal body forwards also promotes flexion. The rotation-movements by which the head is turned to the right or left shoulder take place in the atloido-axial articulation. This permits a rotation-movement either way to the extent of a quarter of a circle. Can this range be exceeded without tearing the ligaments and the spinal-cord? Tarnier thinks that the face may be made to look directly backwards without injury. This may be so

in exceptional cases. But we are sure we have seen fatal dislocation from less extensive rotation.

The Diameters and Circumferences of the Head.

The size and shape of the head constitute most important factors in the mechanism of labour. It may be stated as a general law, that the head bears an approximate relation in size and form to the size and shape of the pelvic canal. This is proved by the fact that the head is driven through the pelvis with some difficulty, showing close correspondence; and without injury to the mother or child, showing mutual accommodation.

The text-books almost universally give the dimensions of the feetal head after birth, that is, after the head has undergone a process of moulding during labour. Dimensions so taken, no matter from what number of observations the average is struck, are necessarily fallacious. They represent not what is postulated—the state of the head at the beginning of labour, that is the primary dimensions—but the resulting or secondary states ereated during labour. Such measurements are seriously misleading. We do not, therefore, think it desirable to reproduce tabular statements of the measurements commonly given.

The measurements which follow are not, it is true, based upon an imposing array of numbers, but upon well-selected, fairly typical examples. We shall start from the original or præ-partum

state, and then trace and eompare the post-partum or secondary states.

If abstraction be made of the lower part of the fætal face, of especially of the ehin, the general shape of the head is found to be more nearly spherical than it is usually represented (see fig. 12.) The diameters of the head are longitudinal, transverse, and vertical. The longitudinal diameters are four, namely:—1. The maximum, MM (fig. 12), measured from the tip of the chin to the most distant point of the skull. This is usually

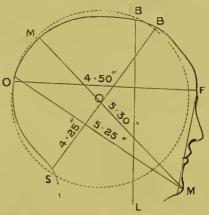


Fig. 12.—Showing the Longitudinal diameters. The dotted circle shows the approach to sphericity of the head.

M M. Maximum diameter. O M. Occipitomental diameter. O F. Occipito-frontal diameter. S B. Sub-occipito-bregmatic diameter. L B. Laryngo-bregmatic diameter.

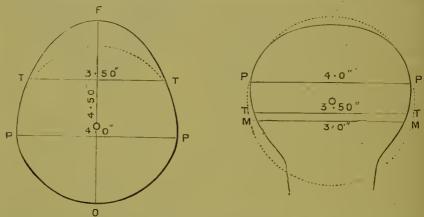
on the sagittal suture, between the point of the occiput and the posterior fontanelle. This point is not fixed. 2. The occipito-mental diameter (O M, fig. 12) measured from the point of the occiput to the tip of the chin. This is often described as the longest diameter; but in fact, a longer one, that described as the maximum diameter, ean almost always be found. 3. The occipito-frontal diameter, O F, extends from the point of the occiput to the root of the nose. 4. The sub-occipito-bregmatic diameter, S B, from the point of meeting of the occipital bone and nucha to the middle of the greater fontanelle.

The transverse diameters are three:—1. The bi-parietal diameter (P P, fig. 13), from one parietal protuberance to the other. 2. The bi-temporal diameter, T T, from the origin of

the fronto-parietal suture of one side to the corresponding point on the opposite side. 3. The bi-mastoid diameter (M M, figs. 13, 14) taken between the two mastoid apophyses.

The vertical diameters are two:—1. The fronto-mental diameter (F M, fig. 12), taken from the highest point of the frontal bone to the tip of the chin. 2. The cervico-bregmatic or laryngo-bregmatic diameter (L B, fig. 12), is taken from the middle of the anterior fontanelle to the upper and anterior part of the neck near the larynx.

Circumferences.—In connection with the diameters, we must note the circumferences. The chief are—1. that running round the head at the maximum diameter: the greatest cir-



Figs. 13 and 14.—Showing the outlines and Diameters of the Fetal Head, O and the transverse Diameters. The dotted circle shows the approach to Sphericity of the Head.

O.F. Occipito-mental diameter, T.T. Bi-temporal diameter, P.P. Bi-parietal diameter, M.M. Bi-mastoid,

cumference, and 2. that running round at the sub-occipitobregmatic diameter: the small circumference; 3. that taken in the occipito-frontal diameter: the equatorial circumference (see fig. 12).

The dimensions of the head are greater in boys than in girls. J. Y. Simpson showed that the larger number of difficult labours occurred with boys; and it has been ascertained that a larger proportion of boys are still-born. It has further been shown that a larger proportion of boys perish within a few weeks of labour, owing to the injury sustained during labour. Not only is the size of the head greater in boys, but in many cases at least, the ossification is more advanced; therefore the plasticity is less. There is evidence to show that the size of the fortal head

has increased under the process of civilisation. A similar contrast is seen between the heads of the savage and the civilised races. Nothing within the range of human anatomy stands in stronger contrast than the cerebral size and development of the New Hollander or the Bushman and the Caucasian races. Education amongst different classes of the same race also affects the size of the brain and cranium. Hatters state that the size of the head is greater in the same classes in town than in agricultural districts, in the educated than the uneducated. Simpson believed that the comparative difficulty of parturition with male and female children extends to the fœtus of civilised and uncivilised races, and he refers the increased suffering of the civilised women in childbirth to the size of the feetal head. We are not aware of any precise data to show that the capacity of the pelvis has been altered under the influences of civilisation.

The Dimensions and Weight of the Child.

Certain properties attached to these diameters must be noted. The longest, or bi-parietal, is not a constant length.

It undergoes shortening under bilateral pressure. In this way it may be reduced by half an inch or more; or it may be reduced by the bone bending or breaking in.

The bi-temporal or bin-aural diameter traverses the sphenoid bone and is unyielding. It is therefore a fixed quantity; and in labour we must count upon this quality. It will be seen that the bi-parietal diameter, when at its extreme shortening, still exceeds the bi-temporal.

The bi-frontal diameter is shorter than the bi-parietal. In labour, with

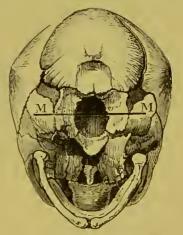


Fig. 15.—Showing the base of the Feetal Skull.

M.M. Bi-mastoid diameter.

projecting promontory, this diameter sometimes gets engaged in the conjugate diameter of the polvic brim, and thus the greater difficulty that would be encountered if the bi-parietal got engaged in this position is evaded.

The vertical diameters are subject to shortening. The

cervico-bregmatic is necessarily shortened under circular compression of the skull. Its shortening is compensated by lengthening of the longitudinal diameters.

The fronto-mental is more fixed. The frontal portion of the diameter, however, is susceptible of shortening, and the component parts of the face yield a little. This diameter assumes importance in delivery after craniotomy.

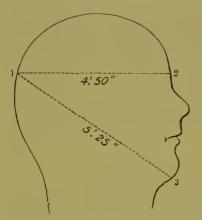


Fig. 16.—The Longitudinal of the Feetal Skull.

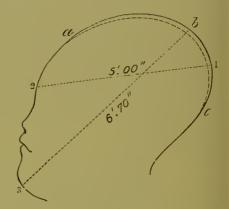


Fig. 17.—Head Moulded in Labour. (Robert Barnes.)

1 to 2. Occipito-frontal. 1 to 3. Occipito-mental. α . Frontal bone. b. Parietal bone. c. Occipital bone.

Both the longitudinal diameters are subject to change in labour. In ordinary head-labours, they are elongated. But under certain conditions they may be shortened.

TABLE OF DIAMETERS OF STANDARD FETAL HEAD, BEFORE MOULDING BY LABOUR.

	Longitudinal		Symbol		Length inehes
1.	Maximum		M.M.		5.25
	Oeeipito-mental .		O.M.		5.0
	Occipito-frontal .		O.F.		4.60
4.	Sub-oeeipito-bregmat	ic .	S.B.		4.25
	Transverse				
1.	Bi-parietal . ,		P.P.		4.00
	Bi-temporal		T.T.		3.20
	Bi-mastoid		M.Mas.		3.0 to 3.25
	Vertical				
1.	Fronto-mental .		F.M.		2:15
	Laryngo-bregmatie.		L.B.		3.75

We have seen that the head is so nearly adjusted in size to the pelvic capacity that it is propelled with difficulty. If both pelvis and head were absolutely rigid, the head would hardly ever pass through by natural forces. The head, therefore, adapts itself by moulding. This means that it changes its shape. The changes undergone are of great interest.

The leading points are stated in a memoir by Robert Barnes.¹ The method of observation adopted was to trace the outlines of the head after birth, and to correct these tracings by measurements taken by the 'compas d'épaisseur.' A better way is to take casts: but the results obtained by the method pursued are fairly trustworthy when checked by repeated observations.

The moulding in occipito-anterior positions.—The occipital elongation, or the 'sugar-loaf head,' is the most familiar deformation. But the attending lateral and asymmetrical moulding which the head undergoes has been little, if at all, noticed. The tracings submitted make this manifest. They prove that under all modes of birth, if the head is a little delayed in transit through the brim, it will be unequally moulded on the two sides. The side which is squeezed against the sacral promontory will be somewhat flattened, whilst the side opposed to the symphysis pubis, suffering generally less compression, preserves more of its normal rotundity.

There is still another deformation, one very difficult to represent by diagrams, sections, or even by photographs. The pelvic canal may be likened to a rifled gun; it is so constructed as to render the propulsion of the fœtal head in a direct course impossible. The head is made to revolve on its own axis during propulsion much as a conical ball revolves on its own axis during its passage through a rifled gun. The difference consists mainly in the circumstance that in the ease of the head, this is, at starting, nearly globular, and acquires its conicity in transit. Now this cone, being the result of the moulding of a plastic body pursuing a helicine course, is somewhat twisted or serewed; and the lowermost part or presenting apex is not found in the median line of the head but on one side

On the Varieties of Form imparted to the Fætal Head by the Various Modes of Birth. Obstet. Trans. 1866. Budin has also made valuable observations.

of the sagittal suture. The deformation is therefore three-fold:—1. Elongation or conification; 2. Asymmetrical flattening of one side; 3. Twisting or screwing of the conified portion on its axis.

After birth, by virtue of resiliency of the components of the cranium and the expansion of the contents, there is a marked tendency to recovery of the præ-partum shape, that is, a force of restitution. The measurements should therefore be taken within an hour or so after birth. Tarnier points out that if we want to get correct data for estimating the original or præ-partum shape of the head, the measurements should be taken two or three days after labour, as by that time the original shape will have been nearly recovered. But admitting to a great extent the truth of this proposition, we believe the original shape of the head is rarely quite regained. Something of the moulding to which it was subjected during labour often remains for years, even through life.

A skilled observer surveying the heads of persons in an assembly, may by help of this key read off with tolerable precision the modes in which a large proportion came into the world. On such a survey it will be seen that the sngar-loaf predominates. It is true that the head retains for some time after birth a certain degree of plasticity, and this property is turned to mistaken account by some people—not otherwise barbarians—in imparting special forms to the head according to the dictates of custom or their ideal of beauty. We do not know that this practice is ever applied to the restoration of the true spherical types. In some cases of excessive distortion this might be justified.¹

Comparing the skull, with its flexible bones, membranes, and scalp, filled with its pulpy brain, with a bag filled with water, we may see that, like this, the skull is incompressible. If it be pressed in at one place it must bulge out in another. The shape may change, but the capacity or volume does not. To pass through a ring or cylinder like the parturient canal, the spherical skull if larger in its equator than is the calibre of the canal, must then be drawn out or clongated so that it

¹ For much interesting information as to the practices pursued by various peoples to impart fanciful shapes to the head and body the reader is referred to an admirable little work of Professor Flower.

shall enter and traverse the canal with one pole of the resulting ovoid corresponding with the axis of the canal, unless indeed the canal itself be distensible enough to stretch as the skull moves on. Now stretching does take place as far as the soft structures of the canal are concerned; but outside and supporting the soft canal is the bony pelvis which yields but slightly, if at all. Thus the stretching is limited (see vol. i., p. 145, 'On the Properties of the Pelvis').

There are then two resisting factors in the problem of propulsion. The passage or parturient canal, and the passenger or fætus seek to adapt themselves to each other, the onc by moulding, the other by stretching. When the sought-for adjustment, by the failure of one or other factor cannot be attained the labour comes to a stand, unless the fætus be reduced in bulk or the canal be enlarged by operation; or, these resources failing, unless the difficulty be evaded by the Cæsarian section.

The moulding of the head is chiefly accomplished by the diminution of its mid-circumference or equator, -a zone traced transversely across the sagittal suture, passing over the protuberances of the parietal bones, descending over the ears, and completed at the base of the skull in the direction of the suboccipital bregmatic diameter (see fig. 12, S B). This circumference admits of different degrees of diminution in different subjects. The part of the circumference made up of the sphenoid and the basilar part of the occipital bone is very nearly incompressible. The yielding is due to the imperfect ossification of the parietal, frontal, and occipital bones, a little to the imperfect ossification of the squamous portion of the temporal bones; greatly to the mobility of these bones, and to the infolding of the occipital upon the 'hinge' described by Budin (see fig. 11). Thus the parietals move inwards on their lower attachments to the temporals and occipital, as on hinges; and their upper margins approach and even override along the sagittal snture. This ring-like diminution in the equator entails bulging backwards or elongation of the occiput.

The next point of resistance is at the shoulders. The average diameter between the tips of the shoulders, the bisacromial, is between five and six inches. It is capable of considerable shortening by the curving forwards of the shoulders.

Where an average head has passed, the passages have been so stretched that the resistance to the shoulders is not often material. Still it has to be considered. There is a second mode of adaptation by which the extreme bis-acromial diameter is practically reduced. As the shoulders descend, one is by a process of leverage brought lower than the other; that is, instead of descending exactly synclitically or in the same planes, the shoulders may come obliquely. This process is successfully imitated in practice when the shoulders are delayed, by gently hooking one down by the finger, or in marked disproportion, by help of a blunt hook slipped into the axilla.

The *chest* is also capable of elongation; but it rarely opposes much difficulty where the head and shoulders have opened the way.

The abdomen also adapts itself without much difficulty.

Lastly, we come to the *breech*. The greatest diameter is the bi-trochanteric. Owing to the imperfect ossification of the feetal pelvis, the breech enjoys some compressibility. The breech alone, as when the legs precede, rarely gives rise to delay. But when to the breech are added the flexed thighs, the combined volume may create as much difficulty as the head. The compressibility of the mass is limited. F. Weber ¹ found laceration of dura mater and effusion of blood between it and the bones, rupture of the longitudinal and transverse tissues of the brain, and considerable hæmorrhage on surface and base of brain, sometimes sufficient to envelop cerebellum and medulla oblongata in cases in which mechanical injuries to bones had occurred, whether or no instruments had been used to complete delivery.

Another property of the feetal skull is *fragility*. The frontal, parietal, temporal, and occipital bones may be fractured. This happens very rarely indeed under spontaneous labour; but it is very important from a medico-legal point of view to recognise this possibility; and from a clinical point of view to recognise the conditions under which it may occur.

Dr. Cory experimented on fifteen children in the same way as Chaussier, and with similar results. The dead children were dropped head-first upon a paved floor, a distance of eighteen inches. Out of the fifteen children experimented upon, eleven

¹ Beiträge zur pathologischen Anatomic der Neugebornen, 1851-4.

had one or both parietal bones fractured. These results are valuable as to showing the very strong probability of a child having its head fractured should it be born suddenly and fall to the ground while the mother is standing. Deep indentation of the parietal at the point of contact with the promontory has been observed in spontaneous labour, head-first and head-last.

Fracture of the cranial bones is of course more frequent in labours assisted by operations, more especially when the pelvis is deformed. 1. The parietal bone, which has to round the projecting promontory of the sacrum, may be indented, even fractured. This is chiefly seen in head-last labours especially if the conjugate diameter of the pelvis be contracted. 2. It may occur also in head-first labours when the forceps is applied above the brim, if the contraction of the brim be marked.

The bones of the cranial vault are necessarily broken in craniotomy and eephalotripsy. The bones of the base of the skull may be erushed down under the cephalotribe. But this, Braxton Hicks has shown, is not necessarily the ease.

The degree of compressibility of the fætal head compatible with life. This is very difficult, if not impossible, to estimate.

Resiliency or elasticity is a property possessed in a high degree by the living feetus, and almost lost in the dead feetus. Resiliency is marked in the head. It is the compensating property to compressibility. After compression, the head, we have seen, to a certain extent recovers its shape. This is due partly to the up-springing of the parietals, frontals and temporals and occipital on their lower attachments, and partly to the resumption of their original shape, just as a piece of cup-shaped thin clastic metal will resume its cup-shape after being flattened by pressure. There is another factor, due entirely to vital action. The pressure taken off the skull, the circulation is restored to the cerebral vessels, and the resulting increase of matter opens out the skull by eccentric pressure, thus aiding the resiliency.

Resiliency in the spinal column. This property is an important factor in labour. The driving force exerted by the shortening of the uterus tells first upon the breech at the fundus. It is propagated through the elastic rod formed by the spinal column. The head is thus forced down upon the eervix uteri. This structure offering resistance, the body of the fectus bends

a little under the pressure encountered at its two ends. But it is constantly tending to straighten itself, and thus the containing body, the uterns, gradually yields at its weakest point—the cervix—which is made to open. It is partly upon the preservation of this property that success in version, spontaneous or operative, depends.

The *chest* also is encowed with resiliency. It may undergo considerable elongation under compression, and yet, as soon as the pressure is taken off, its walls expand again. This has not a very obvious relation to the mechanism of labour; but it is all-important as a factor in respiration. During the passage of the chest through the parturient canal it is compressed; but the moment it is born, the chest-walls, expanding by virtue of their elasticity, suck in air. This, Robert Barnes insists, is a main factor in inducing the first respiration.

The compressibility of the abdomen is proved by the occasional squeezing out of meconium during the passage of the trunk through the pelvis. This squeezing must be distinguished from the evacuation which sometimes takes place as a vital act under attempted inspiration.

Ductility is another property. It is a form of plasticity. The spinal column is not so rigidly set but that it is susceptible to a moderate degree of drawing out under traction. This property hardly comes into application in head-labours; but in head-last labours, when it is necessary to put on vis à fronte, traction on the legs entails dragging on the spine. It is difficult to estimate even approximately the force that can be so used without lacerating the vertebral ligaments. So-called laboratory experiments on the dead focus, which consist in putting on a succession of weights to determine the resisting power, are of no value for clinical application. The conditions are essentially different from those which obtain in the living subject. It is certain, in the first place, that a live feetns, or one dying during the labour, will bear a greater strain. In the second place, it is all but impossible to measure the resistance offered by the pelvis and other forces. In practice we are satisfied that, by delieate management, we have occasionally brought out a living child by help of an amount of force that would have torn a dead child out of the body asunder. The opposite conditions of the two eases negative comparison.

It is important to notice the weakest point of the spinal column. Under strain it gives way at the eervico-occipital union. This may be partly because the strain is usually concentrated upon this point. The head, caught in the pelvic brim when traction is put on below, the occipito-cervical joint is the centre upon which the force tells.

The Plastic Phenomena of Labour.

Deformations of the Fœtus produced during Labour.

Although the soft parts of the genital eanal are dilatable, they offer resistance enough during dilutation to impart certain changes of shape to the fœtus. The soft parts indeed, alone almost, produce the sero-sanguineous swellings which are observed on the surface of the ehild's body after birth. The same conditions which produce the sero-sanguineous swellings are also adequate to produce certain changes in the form of the cranial bones. Certainly they occur in cases where the pelvis is well-formed, and where the child is born alive and capable of thriving.

When describing the process of labour under the several presentations and positions, the special characters of the serosanguineous tumours and of the cranial deformations formed will be referred to.

We may in this place point out some general features and the ruling etiological conditions.

The cranial deformations are produced by the compression which the head undergoes during its propulsion through the pelvis. Before entering the pelvis the head is nearly spherical. In this form its equator may be too large to enter or to traverse. A process of adaptation therefore takes place, by which its equatorial diameters are reduced, and other dimensions are increased. It is accommodation by moulding.

The most typical of the sero-sanguineous swellings is that which forms on the head, and which is called the caput succedaneum, as if a secondary head were developed. whatever the part that presents, analogous swellings are formed unless the labour be rapid and easy.

The most natural explanation of the etiology of these serosanguineous swellings is that they are the effect of annular constriction. Thus, the primary swelling is due to the os uteri encircling the presenting part of the head as a tight ring; the arteries of the scalp propel blood into the part of the scalp which protrudes through the constricting ring, whilst the compressed veins cannot return it; hence extravasation of serum and sometimes blood. The secondary swelling is due to similar constriction of the vulva. It is thus seen that the formation of the caput succedaneum, and of the equivalent swellings on the face, breech, or shoulder, is a vital phenomenon depending upon the circulation.

Cephalhamatoma. In the ordinary cases the effusion is ehiefly or entirely serous; in others there is blood as well as serum, that is, ecchymosis. The seat of these infiltrations is the subcutaneous connective tissue. These are the ordinary forms of the caput succedaneum. They entail no danger to the child; the effused fluids are rapidly absorbed, so that after two or three days barely a trace of even large swellings is perceived. But in a distinct class of cases this sero-sanguineous intracellular infiltration is complicated with blood-extravasation between the periosteum and the bone. The periosteum is raised by a layer or mass of dark blood, the bone from which the membrane is separated is stained red, the capillaries of the diploë are gorged with blood. The dura mater of the corresponding inner surface is also detached by a thin layer of dark fluid blood. The sinuses of the dura mater are filled with black blood. The pia-mater is reddish; its capillaries are gorged with blood; the choroidal plexuses are deeper-coloured than usual. These cases are of graver import. The child not uncommonly perishes, either from the immediate effects of the effusion or from the attendant compression of the brain, and other injuries.

In these latter cases some greater force than that exerted by the soft parturient canal has been in operation. Pelvic distortion or contraction, or undue size of the head, or the use of instruments have commonly concurred.

Several important lessons, clinical and medico-legal, may be drawn from the study of these sero-sanguineous tumours and cranial deformations.

First, we have seen that the formation of the sero-sanguineous swellings is a vital act. Therefore the child, even

if not born alive, was living during the propulsive stage of labour.

Secondly, by eareful examination during labour, we may watch and observe the formation of the scalp-tumour, and gather from this the conclusion that the child is living.

Thirdly, we may after birth determine very closely the part of the child which presented and the position of the presenting

part during labour.

Fourthly, we learn from the cranial deformations to estimate the *plasticity of the fœtal head*. The simple caput succedaneum varies in site according to the position of the head.

- A. The caput succedaneum in occipito-anterior positions. In these positions, the head advancing, the occiput is on a lower level than the forehead, and the parietal bone, which is anterior or nearest to the symphysis, is lower, that is nearer the centre of the os uteri, than the posterior parietal bone. The consequence is that the swelling forms chiefly on the anterior parietal, and more especially on the upper and posterior angle near the union of the sagittal with the lambdoidal suture. Thus, in the first or left occipito-anterior position the swelling is formed over the upper and posterior angle of the right parietal, encroaching on the lesser fontanelle and occiput. In the second or left occipito-anterior position, the swelling is formed over the left side of the cranium.
- B. The caput succedaneum in occipito-posterior positions. In these positions the swelling occupies the upper and anterior angle of the parietal, which corresponds to the pubic arch, encroaching a little upon the larger fontanelle and even upon the frontal bone.

By observing the seat of the caput succedaneum we may form a retrospective diagnosis of the position. If the head traverses the vagina and vulva rapidly, the primary swelling described may be in its simple state; but if the head has been delayed long after passing the os externum after its rotation, a secondary swelling is formed nearly in the median line. The first swelling subsiding somewhat may attract less attention than the secondary one; but there will always remain some degree of laterality of the swelling, which will indicate the position the head occupied at the pelvic brim.

C. The sero-sanguineous swelling in face-presentations. When the face presents, the equivalent of the caput succedaneum forms on the face. In mento-anterior positions the swelling will be on the inferior part of the malar region and the side of the mouth, and on the upper part of the malar region, and even on the eye in mento-postcrior positions. The greatest swelling will be seen where the sub-cutaneous connective tissue is loosest; hence the eyelids are so swollen that they cannot open. The expression given is most ghastly, suggesting severe violence. The upper lip and malar region also are liable to great effusion. The swelling sometimes extends to the sub-mucous tissue, so that the child may be unable to suck for some days. The colour of the swollen parts is deep-blue or black. The swelling, formidable as it looks at birth, goes down with astonishing rapidity, so that at the end of three days there is rarely much to be seen.

D. The sero-sanguineous swelling in breech-presentation. When the breech presents, the tumour is formed more especially on one buttock, and commonly invades the genital organs. In the right saero-iliac positions the swelling is on the right buttock; on the left buttock in left sacro-iliae positions. The female genitals show the swelling less than the male genitals. The swelling of the scrotum and penis is at times extensive, and the size and deep-blue or black colour may suggest to the unskilled the conclusion that they are the result of severe violence inflicted by the obstetrist. This swelling also rapidly subsides, leaving the child uninjured. When the knees or the feet present, like swellings are formed, but they are less marked.

E. When the shoulder presents, the swelling is formed upon the prominent part of the shoulder, if this part occupied the eentre of the pelvis; but it extends backwards or forwards as the presentation inclines to one or the other direction. When the arm or the fore-arm come down, the swelling forms upon these parts. In cases in which the shoulder presents at first, and when the arm comes down later, the arm may become enormously swollen, and dark-coloured, if long subject to compression at the shoulder.

THE MECHANISM OF LABOUR.

Being now in possession of the requisite knowledge of the factors of labour, namely, the pelvis (see vol. i. chap. vi.), the feetns, and the driving-force, or as Alexander Simpson alliteratively describes them, the passages, the passenger, and the power, we are enabled to trace the mechanism of labour.

It is usual to begin the description of the mechanism of labour with the adjustment of the presenting part of the fœtus upon the brim of the pelvis, and then to trace the progress of the fœtus through the pelvic canal and outlet. In this way a very important part of the process is overlooked or inadequately noticed. The pelvic course of the child is but one part; before this part is run, the child has to go through a supra-pelvic course. This supra-pelvic course determines the lower or pelvic course; and in many cases it governs the position of the presenting head or breech.

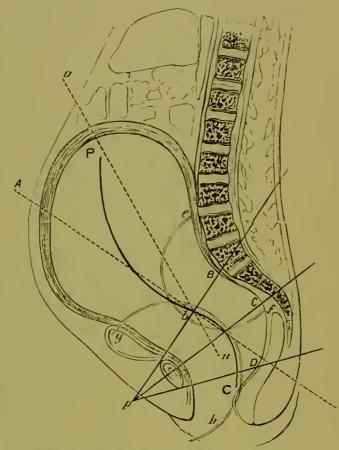
It is true that in many cases, especially in primiparæ, the fœtal head has engaged in the pelvic cavity, partly at least, before the advent of active labour. But even in these cases, we must admit a preliminary stage, not indeed marked by active uterine contraction, during which the presenting part, especially if this be the head, is made to traverse the suprapelvic part of the parturient curve, carrying down the inferior segment of the uterus before it. This preliminary stage is effected often some days or a fortnight before active labour, marked by expansion of the cervix uteri, sets in. It is not the less a part of labour.

Reference to the diagram (fig. 18, p. 144), will show that the child must follow a track governed by the shape of the lumbar spine, the sacral hollow and the outlet of the pelvis. This track has for its elementary, constituents two principal curves:—

1. The lumbo-sacral curve, drawn from the sacral promontory as a centre, with a radius intersecting the middle of the plane of the brim. This (fig. 18 e, f) is Barnes' curve. The second is

¹ This subject is discussed in a memoir 'On the Mechanism of Labour, especially with reference to Naegele's obliquity, and the influence of the lumbo-sacral curve,' in the Obstetrical Transactions, 1884, by Robert Barnes. In the same volume is a valuable contribution to the same problem by Dr. Galabin.

that familiarly known as Carus' curve. This is drawn from the symphysis pubis as a centre with a radius following nearly the axis of the pelvic cavity (fig. 18 g h). These two curves cut each other about mid-pelvis. This point of intersection may be taken to indicate the merging of Barnes'



F_{1G}, 18.—Constructed on Chiara's Frozen Section to show the axes and curves of the Uterus and Pelvis. (Robert Barnes.)

A D. Axis of brim of pelvis. au. Axis of uterus. A ba. Augle of divergence of uterine axis from pelvic axis. p B. Plane of brim. p C. Plane of cavity. p D. Plane of outlet. ef. Barues' curve. gh. Carus' curve. P C. Parturieut curve.

curve into Carus' curve, and thus the changing of the course of the advancing head from the axis of the brim to the axis of the outlet.

These two curves have for their resultant the true 'parturient curve,' a scrpentine or double curve, which, in parenthesis, may be likened to 'Hogarth's line of Beauty' (see fig. 18 P.C). The first or upper part of this curve has been generally

neglected. The lumbo-sacral curve itself may be studied in two parts, namely, the part above the pelvis, or most prominent point of the promontory, and the part below this point. The upper part must be drawn with a larger radius than the lower.

The basis of it is the lumbar spine terminating at the promon-The lumbar spine forms an inclined plane with a moderate curve, upon which the uterus and the contained fœtus are moulded. The uterus forms a concavity in its posterior wall to fit the convexity of the lumbar spine; and the contained fœtus fitting itself to the containing uterus also forms a corresponding concavity in that aspect which looks to the mother's spine. Indeed, we contend that it is this necessary accommodation of the uterus and fœtus to the mother's spine which determines the ordinary dorso-anterior attitude of the fœtus. The mechanism is obvious. The lumbar spine forms an unyielding projecting rounded surface; the child's spine is also the most unyielding part of its body, it forms a prominent curve in length and in width. Now when two such curves come into contact, the movable body must be deflected, that is, the child's spine is turned aside, and the continuous pressure of the abdominal walls upon the uterus, aided perhaps by the movements of the uterus itself, help to bring the child's back more forwards. But some degree of obliquity of the uterus and of the child's body is almost constant. Tarnier describes the uterus as rotated or twisted on its long axis. The uppermost part of the child and the fundus of the uterus usually point to the right of the median line. Hence the axes of the uterus and of the child do not coincide with the axis of the pelvic brim, as Küneke and others, who, basing upon this assumed coincidence, deny Naegele's obliquity, contend.

Reference to Braune and Chiara's sections of frozen bodies taken in labour will show that the axis of the uterus forms with the axis of the pelvic brim an angle of about 15°. This is

also proved by Schatz.1

The inevitable consequence of this disposition is, that the head descending along the lumbar incline or upper part of Barnes's curve, enters the brim obliquely as regards the pelvic axis, and not synclitically, as Duncan, Küneke, Leishman, and others postulate.

¹ Der Geburtsmechanismus der Kopfendlagen, 1868.

It is urged that under the action of labour the uterus tends to become more erect, and thus that its axis tends to coincide with the axis of the pelvic brim. That there is such a tendency may be granted, but that coincidence is attained is not proved. The proper inherent action of the uterus may tend to erection, but the attendant action of the abdominal muscles, powerfully compressing the anterior wall and especially the fundus backwards, must counteract the effect of erection, and carry the axis of the uterus back towards the mother's spine. This Schatz points out as well as ourselves. Again, in primiparæ, the entry of the child's head into the pelvis is often effected before the uterus has entered into active contraction or erection, and whilst its axis is certainly not coincident with that of the uterus. And again, the axis of the uterus is never straight; it is a curved line answering to the curve of the child's body and to the parturient curve.

It is convenient in this place to describe the three obliquities of the fætal head. These are:—

- 1. Ræderer's, or the occipito-frontal obliquity. The head may be imagined as rotating on its transverse axis so that the occiput drops, and therefore dips in the pelvis, standing at a lower level than the sinciput.
- 2. Solayrès' obliquity. Solayrès, in 1771, demonstrated that the head entered the pelvis in an oblique diameter of the brim.
- 3. The third is Naegele's obliquity. Naegele thus describes it:- In that presentation of the head which occurs most frequently, the head presents not with the occiput but with the vertex; in fact, with the right parietal bone, the posterior fontanelle being turned towards the left acetabulum. Upon examination at the beginning of the second stage of labour (i.e. when the os uteri is opening), and in those who have had children, the finger introduced in the direction of the central or middle line of the pelvic cavity, and brought in contact with the head, will touch the right parietal bone in the vicinity of its tuber; the two fontanelles are mostly found situated at an equal height, sometimes the anterior, but more frequently the posterior one a little lower. At the entrance of the pelvis the head does not take a perpendicular but a perfectly oblique direction. So that the part which lies lowest or deepest is neither the vertex nor the sagittal suture, but the right

parietal bone. The sagittal suture is much nearer to the promontorium than to the os pubis, and divides the os uteri, which projects backwards and generally somewhat to the left, across into two very unequal segments.'

Naegele enforced this statement by the observation of the caput succeedaneum which forms upon the posterior and upper quarter of the right parietal bone (the first position being understood), and if delayed at the outlet, then covering the right parietal bone and a part of the occiput.

Naegele also insisted that the head preserved somewhat of the Solayrès' obliquity even at the outlet of the pelvis and during its exit. This, which was not generally recognised at the time when he wrote, is now universally admitted, Küneke alone excepted. But Naegele further showed that his own obliquity was also preserved to the end. He says: 'When the head has sunk completely into the cavity of the pelvis and approaches the external opening, the posterior fontanelle is still found corresponding to the left foramen. . . . The right tuber parietale will be felt distinctly clearing the labia before the left.' There must, then, be obliquity of the head at this stage.

These conditions, it will be seen, are incompatible with the theory of synclitism—a theory so much insisted upon in recent times. We may in this place briefly explain this theory. The simplest idea or representation of synclitism is obtained by observing the structure and action of a pump. This consists of a straight eylinder and of a piston accurately fitted to it and capable of working up and down. The mouth of the cylinder cut at right angles to the tube represents a plane. We may imagine any number of planes at lower points of the cylinder parallel to this plane of the mouth. The rod of the piston represents the axis of the cylinder. The disc of the piston is set exactly at a right angle to the piston, and therefore to the axis of the eylinder. The piston is further set exactly in the centre of the disc, and is fixed there. Now, when the piston is worked down, the disc necessarily standing in the plane of the cylinder, and encountering equal resistance at every point of the circumference, is in stable equilibrium, and its plane keeps parallel with the planes of the cylinder in which it moves. This, then, is synclitism: coincidence of the plane of the disc with the planes of the cylinder which it encounters.

Contrast this case of the pump with that of the uterus, child, and pelvis. The partnrient canal is the assumed analogue of the cylinder of the pump. It is not straight, but a sigmoid curve; it is not of equal calibre, but expands under the sacral promontory (see vol. i., Table, p. 179, and figs. 64, 65, p. 182); the driving-force or piston, the uterns, does not work perpendicularly to the plane of the pelvic brim, but at an angle behind it; the disc—that is, the base of the child's head—is not fixed to the driving-force, nor centrally, but is movable upon the piston. The conditions are all contrary to those necessary for the production and maintenance of synclitism.

It is important to note that whilst Küncke contends for synclitism throughout, Duncan, Leishman, and others only contend for synclitism as far as the floor of the pelvis; here parting company with Käneke and joining Naegele in asynclitism to the end.

The Planes of the Uterus and other soft parts as Factors in determining the Position and Course of the Fætal Head.

Closely associated with the lumbo-sacral curve, and forming integral parts of the parturient enrve, are the planes of the uterus and floor of the pelvis. These, too, have been greatly neglected in the study of the problem. They are described and figured pp. 23, 24.

We may here supplement this description by adding the supra-pelvic plane of the uterus—namely, that formed by the posterior wall of the uterus resting upon the lumbo-promontorial enrve. This incline first gives the direction to the head in its descent. Standing at an angle behind the plane of the brim, the head, resting upon the solid incline, necessarily encounters greater resistance at its posterior or sacral side than it does at the anterior or pubic side. This greater resistance is proved by the flattening (amounting at times to indentation) of this side, observed in almost every labour. The driving-force impelling the head onwards makes it rotate to some extent on its long axis, the pubic side describing a larger segment of a circle—that is, the anterior side of the head gets lowest; that is, Naegele's obliquity takes place at the very beginning of labour.

Arrived at this point (the brim), the head must change its

course in order to double the sacral promontory. The anterior uterine valve now comes into preponderant work, directing the head back into the saeral hollow. The side of the head in eon-

head back into the saeral hollow. The side of the head in contact with the promontory still encounters the most resistance; the anterior or pubal side moving faster, descends more rapidly—that is, Naegele's obliquity is increased.

Arrived in the eavity of the pelvis, again the head must change its course to clear the outlet by Carus's curve. Now comes the perineal, posterior, or vulvo-vaginal valve—the pelvic floor (see fig. 2, p. 24). This directs the head forwards. Although the chief resistance is now encountered by the pubal side of the head, this side still maintains a lower position as side of the head, this side still maintains a lower position as regards the planes of the pelvis—that is, Naegele's obliquity is observed throughout the whole course of labour: there is

asynclitism from beginning to end.

We may here fitly dispose of the objections that have been urged against Naegele's doctrine. The principal objections may be stated as follows:—

- 1. The fundamental objection urged by Küneke, and relied upon by Duncan, Leishman, and others, is that the three axes of the plane of the brim, of the uterus, and of the fœtus, coincide. This, we have seen, is a fundamental error. The axes do not coincide.
- 2. Subsidiary to the first objection is the assertion of Leishman that Naegele was ignorant of the inclination of the pelvis to the horizon. This is in direct opposition to Naegele's demonstration.
- 3. That the obliquity in question is not observed, Duncan affirming that 'Naegele fell into error from not making the observations relied upon at the brim of the pelvis, and then only.' This is simply an arbitrary assumption. Naegele expressly says that he kept his finger on the presenting point at and from the beginning of labour.
- 4. That it is impossible to find a mechanism to account for it (Dunean); that it would answer no useful purpose (Leishman); that it would answer no disert purpose (Bershman); that there is always present plenty of room for the head to pass directly (Küneke). These objections resolve themselves into the same thing. We have seen amply adequate mechanism in the form of the parturient eanal, in the jutting promontory, in the narrow conjugate diameter of the brim, in the expanding

cavity of the pelvis below the promontory, in the shape of the head, and in the action of the utcrine planes. We have seen that the head is widest in its biparietal diameter, and that a clear gain is obtained by substituting the oblique subparieto-superparietal diameter (Galabin).

- 5. Leishman urges against Naegele his statement that 'the higher the head is, the more oblique is its direction, for which reason the ear can generally be felt behind the pubes without difficulty, which could not be the case if the head had a straight direction.' We might grant that the obliquity is not greater in proportion to the height of the head, still it would not follow that the head is not oblique at the brim.
- 6. The situation of the caput succedaneum as seen after birth, invoked by Naegele, is objected to because this swelling varies according to the stage of labour, so that what is produced at the end of labour may be mistaken as the product of causes acting at the commencement. There is some force in this argument; but still it is not contended that the caput succedaneum, as usually observed, is inconsistent with Naegele's theory; and having ourselves made careful observations ad hoc, both in propitious and in difficult labours, effected mainly by the forceps, we can affirm that the head seized near or on the brim has been brought through the pelvis, preserving the caput succedaneum as it originally formed over the right tuber and posterior angle of the parietal, no complicating change subsequently occurring.

It might be supposed that this question might be settled by the simple process of observation of a labour in progress. But whether it be under the influence of preconceived theory, or of the inherent difficulty of accurate determination of the relative positions of the parts, observers have come to conflicting conclusions. We therefore do not rest the case upon our own clinical experience, conducted through many years under exceptional advantages and, we hope, with adequate skill and candour. No one can hope to excel Naegele himself as an observer. We therefore appeal to the study of the mechanical factors for the solution of this fundamental problem in labour.

We may now sum up the case.

1. Naegele's obliquity is a real, and probably nearly constant, phenomenon in natural labour.

- 2. It is a necessary result of the combined action and relations of the factors working in the mechanism of labour, namely, the lumbo-sacral curve; the adaptation of uterus and feetus to this curve through the backward pressure of the abdominal walls; the consequent throwing back of the fundus, and therefore of the axis of the uterus behind the axis of the brim of the pelvis; the jutting of the promontory forwards contracting the conjugate diameter below that of the biparietal diameter of the feetal head; the consequent facility gained for the head to enter the brim by the substitution of a lesser or oblique diameter; the expansion of the pelvis below the promontory to a nearly circular form, compelling the head in obedience to the law of accommodation to adapt itself to the space under the promontory guided by the anterior uterine plane.
- 3. As E. Rigby expresses it: 'the head enters, passes through, and emerges from the pelvis obliquely; and this is the case not only as to its transverse diameter, but also as to the axis of its brim, the side of the head being always lowest or deepest in the pelvis. This shows the beautiful mechanism of the process, for, on account of its oblique position, there is no moment during the whole labour at which the greatest breadth (still less length) of the head is occupying any of the pelvic diameters.'

Naegele examines the cases of other presentations of the head and of the breech, and shows that all are subject to the same law.

Note.—The student is recommended to follow the description of the positions of the presenting part, and to track them through the pelvis, by help of a feetal skull and woman's pelvis. It is better still to do this by using a whole feetus. If he has access to Budin and Pinard's phantom, the imitation of Nature is almost perfect. Failing these, the description may be very fairly realised, by cutting a hole in a card of the shape of the pelvic brim, and using with it an artist's jointed lay figure. It is important to use a feetus or a whole figure, since much confusion and error arise from using only a part of the feetus—its skull.

Presentation of Cephalic Extremity.

The Head.—There are four principal positions of the head-presentation.

Of these, two are occipito-anterior and two occipito-posterior.

- 1. The right occipito-anterior, usually called the first position, as being the most frequent. The forehead is directed to the right sacro-iliac joint, or at any rate to a point behind the right end of the transverse diameter. The symbol is R.O.A.P.
- 2. The *left occipito-anterior*, or *second position*. The forehead is directed to the left sacro-iliac joint, or at any rate to a point behind the left end of the transverse diameter. Its symbol is L.O.A.P.
- 3. Right occipito-posterior position, or third position. The posterior fontanelle is directed to the right sacro-iliac joint. Its symbol is R.O.P.P.
- 4. Left occipito-posterior position, or fourth. The posterior fontanelle is directed to the left sacro-iliac joint. Symbol, L.O.P.P.

5 and 6. The head may present in the transverse diameter. The occiput may be directed to the right or to the left. Thus we may have a right and a left occipito-lateral position. Practically these positions rarely last beyond the first stage of labour. When the head descends into the pelvic cavity, the occiput almost invariably turns forwards or backwards.

The simplest formula for enumerating the head-positions is to carry the occiput round the circumference of the brim from right to left, beginning with the left occipito-anterior position. This then, occiput to left foramen ovale, being by far the most frequent, may be taken as the type, and is No. 1. Taking the occiput over to the right, we get No. 2. Thus we have the two occipito-anterior positions.

Continuing the circuit, the occiput is carried to the right sacro-iliac joint; this is, No. 3. Still continuing the circuit we carry the occiput to the left sacro-iliac joint; this is No. 4. Thus we have the two occipito-posterior positions.

This order differs from those sometimes adopted. But we describe it as the most simple and the easiest to remember: 1 and 2 are occipito-anterior; 3 and 4 are occipito-posterior. This order is further in accordance with natural affinity. Thus the third position tends to resolve itself into its nearest anterior position, that is the second; and the fourth in like manner tends to resolve itself into its nearest anterior position, the first. In either case, the occiput tends to come forward, that is,

the occipito-posterior positions tend to be converted into occipito-anterior positions. The first and fourth positions belong to the left side of the pelvis. The second and third positions belong to the right side of the pelvis.

The Face.

The presenting face is recognised by the feel of the nose, lips, jaws, chin. It is generally high up at the beginning of labour, not so easy to reach as the vertex.

There are two mento-posterior positions and two mentoanterior, corresponding to the positions of the vertex.

The face-presentations may be tabulated as follow:—

The face procedured may be distanced as form.								
sacro-iliac joint=	right	to the	directed	is	chin	The	1.	
symbol, R.M.P.P.								
sacro-iliac joint=	left	"	,,		"		2.	
symbol, L.M.P.P.								
ht cotyloid cavity=	righ	"	,,		22		3.	
symbol, R.M.A.P.								
cotyloid cavity=	left	,,	,,		,,		4.	
symbol, L.M.A.P.								

If we examine the relations between the vertex- and the face-presentations, we observe that, holding the skull in the first vertex position, over the brim of the pelvis, lightly poised between finger and thumb on either parietal protuberance, and then letting the face drop, the skull rotates on its transverse axis, we get the first face, or R.M.P.P.

If again, holding the skull in like manner in the second or left occipito-anterior position, we let the face drop, we get the second face, or L.M.P.P.

Again, holding the skull in the third, or R.O.P.P., and letting the face drop, we get the third face, or R.M.A.P.

And, holding the skull in the fourth, or L.O.P.P., and letting the face drop, we get the fourth, or R.M.A.P.

Tabulated, the relations are seen as follows:--

	Vertex.			Face.
1.	R.O.A.P.	gives rise to	1.	R.M.P.P.
2.	L.O.A.P.	,,	2.	L.M.P.P.
3.	R.O.P.P.	"	3.	R.M.A.P.
1	$T_{\bullet} \cap P_{\bullet} P_{\bullet}$		4.	T. M A P

Nor is this an arbitrary construction. The conversion of a vertex-presentation into a face- is what really occurs. Originally postulating a well-formed fætus, the presentation is very rarely indeed facial. Face-presentation is produced by the comparative arrest of the occiput against the lower segment of the uterus and the brim of the pelvis. The broader expanse of the occiput presents greater resistance; the driving-force continuing is propagated along the fætal spine, and the less resisting arm of the head-lever, the face, descends, the skull rotating on its transverse axis.

This happens when there is such obliquity of the uterus that the skull cannot present fairly in the centre of the pelvic brim. It may also happen where an inclined plane is formed on one side of the lower segment of the uterus by the placenta being attached to it. This will throw the skull obliquely over the brim.

Presentations of the Pelvic Extremity.

The Breech.

Theoretically we may trace four positions of the breech, as we have done of the skull and face. We may even evolve the four breech-positions out of the four typical head-positions by a method similar to that by which we have evolved the four face-positions. The law of adaptation of the contained and containing parts rules the mechanism of breech-first labours as it does that of head-first labours.

Breech-presentation is evolved out of head-presentation in the following manner:—Suppose the presentation be, primarily, the first vertex. The head, instead of entering the pelvis, slides off to the left ilium. The breech—the other end—of the fætal ovoid or lever descends in the opposite direction. The child continuing to rotate on its transverse axis, the head and breech at last change places, the head occupying the fundus of the uterus, the breech the inferior segment of the uterus, and presenting over the pelvic brim. This revolution is favoured by the frequent inclination of the fundus of the uterus to the right.

It will be remembered that, in the case of the breech, the representative of the longest diameter of the head is the transverse, or bi-trochanteric diameter. This diameter then takes

up its position in an oblique diameter of the mother's pelvis. Following out the revolution described, the breech will come into the opposite oblique diameter to that which had been occupied by the skull—that is, it will be in the left oblique diameter, the abdomen looking forwards. Each head-position has its analogous breech-position. Thus the second head is converted into the right sacro-cotyloid of the breech abdomino-anterior; the third head-position has its analogue in the left sacro-cotyloid of the breech dorso-anterior; and the fourth

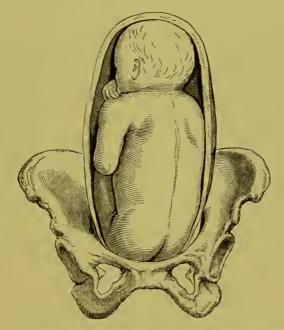


Fig. 19.—Dorso-anterior presentation of the Breech.

head-position has its analogue in the right saero-eotyloid breech dorso-anterior.

These evolutions have actually been observed in the living subject, and they can be produced by manipulation.

We thus find that there are two abdomino-anterior positions of the breech, and two dorso-anterior. The two first are evolved from the two occipito-anterior positions; the two latter from the occipito-posterior positions; so that there is a change of front of the fœtus.

In practice it is enough to distinguish two breech-positions—namely, dorso-anterior and abdomino-anterior positions, without further differentiation.

The normal attitude of the fœtus, in which the thighs, are

flexed upon the belly, and the legs flexed upon the thighs, is commonly present in breech-presentation.

Knee-presentation is simply a variety of the breech. The positions are the same. They are produced by dropping the knees. By a further dropping of the legs we get corresponding footling positions. The relations of the breech and trunk to the pelvis remain the same.

Another variety is that in which the thighs are flexed upon the belly and the legs extended, so that the feet rest upon the shoulders.

The Trunk. Arm- or Shoulder-Presentations.

If we follow the same process as that described for the production of breech-presentations and positions in the case of the trunk, we shall find that the first R.O.A.P. is converted into the left shoulder abdomino-anterior position, the L.O.A.P. becomes the right shoulder abdomino-anterior position, the R.O.P.P. becomes the left shoulder dorso-anterior position, and the L.O.P.P. becomes the right shoulder dorso-anterior position. Thus we find two dorso-anterior and two abdomino-anterior positions of the body, the shoulder being usually the presenting part. The dorsum being forward, the head may lie in the right or in the left iliac fossa, and so when the abdomen is forward the head may be to the right or to the left. In practice it is important to distinguish these four positions. The scientific performance of version depends upon making this distinction.

TABLE OF PRESENTATIONS AND POSITIONS, SHOWING THEIR EVOLUTIONS AND MUTUAL RELATIONS.

No. of	Head or	Pelvic extremity					
No. of position	n, skull	Face	Breech	Knees	Shoulder		
1.	R.O.A.P.	R.M.P.P.	L.A.A.P.	as breech	L.D.A.P.		
2.	L.O.A.P.	L.M.P.P.	R.A.A.P.	"	R.D.A.P.		
3.	R.O.P.P.	R.M.A.P.	L.D.A.P.	"	R.A.A.P.		
4.	L.O.P.P.	L.M.A.P.	R.D.A.P.	,,	L.A.A.P.		

This table exhibits the correlative positions of the different presentations, or the evolution of the face-, breech-, and shoulder-positions from the head-positions. It will be seen that the relations of the breech and shoulder to the head are the same. The abdomen in each case is substituted for the occiput.

The nomenelature or order of the positions above set out differs from that adopted by other authors. The essential thing to remember, however, is not

Complicated presentations are:

- 1. Presentations or prolapsus of the umbilical cord.
- 2. ,, of the placenta.
- 3. ,, of uterine tumour or polypus.

Diagnosis of the Attitude of the Fætus, and of the Presentations and Positions.

When the uterine walls are gently pressed by the flat hands, we soon perceive that the uterine globe offers different resistance in several points. Wherever the liquor amnii is accumulated, the uterine wall yields softly, the fingers feeling little resistance. The same is nearly the case at the seat of the placenta. When, on the contrary, the hand meets a solid part, this, in normal gestation, certainly indicates a feetal region. From the fifth month, in the great majority of cases, not only do we recognise that a feetal part is under touch, but with a little practice we distinguish the several parts.

The fœtus is always rolled up on its anterior aspect. head is known by its forming a mass nearly spherical, regular, large, and very resisting. These characters are marked. The breech presents a voluminous rounded mass which might impose for the head, but it is never so spherical or hard. Moreover, at the side of the breech we nearly always feel the pelvic limbs, or one of them. When in doubt, a comparative examination of the two ends of the feetal ovoid will clear up the difficulty. And cephalic ballottement gives an additional means of distinguishing head from breech; this manœuvre will be described further on. Between the head and breech we find the back. This is sometimes applied directly against the uterine wall, sometimes separated from it by a thin stratum of water which is easily displaced by the hand. It presents a large surface, less hard than the head, nearly flat from side to side, convex in its length. In easy cases the abdominal walls are very thin, and the vertebral column can be traced by almost counting its spinous processes. When the characters presented by the back are obscure, we carry the hand over to the opposite side of the abdomen, where we ought to find a layer of liquor amnii, and

the name or number of a position, but the relations of each position to the pelvis. Our scheme may be called a natural one, inasmuch as all the face, breech- and shoulder-positions are shown to flow from the head-positions.

in the midst of it we shall make out the prominences formed by the thoracie and pelvie members; and thus we acquire the eonvietion that it is the back which we have felt on the other side. Sometimes the back is directed obliquely backwards and to the right, or backwards and to the left; then we can only explore its side and the thorax, which obscures a little the diagnosis. When the back is turned almost directly backwards, it escapes palpation, but then the thoracic and pelvie limbs are



Fig. 20.—Diagnosis of Breech-presentation. (After Pinard.)

felt in front, and we know the back is behind. These limbs correspond to the anterior surface of the child, and indicate its position; they are easily recognised by their smallness and mobility.

Diagnosis of the presentation of the vertex. The hands are applied on either side of the hypogastrium, the finger-tips directed to the groins. Then we depress the abdominal and uterine walls, pressing more strongly with the finger-ends than with the palms, and most frequently the head will be made out

by its distinctive character. It is seized between the two hands. In primipare it will be remembered that the head often dips entirely in the pelvic cavity, and that it thus evades superficial exploration of the hypogastric region. In these cases, we must press the finger-ends above the horizontal branches of the pubes, push back deeply the abdominal walls into the true pelvis, proceeding from above downwards and from before backwards, and we soon feel a resisting body, the feetal head filling the cavity. This done, we check the result by examining above for the breech, and the sides for the back. Diagnosis of presentations of the face. When we have

Diagnosis of presentations of the face. When we have discovered a head-presentation, how can we tell if it be flexed or extended, whether, in short, it be a vertex- or a face-presentation? When the vertex presents, one feels a slight depression between the back and the head at the nucha; when, on the contrary, the face presents, the occiput is thrown back upon the back, so that between these two parts there exists a considerable depression, easily appreciable to touch, and forming a large sinus quite characteristic. When the face presents, the cephalic tumour, says Pinard, seems to occupy only one side, or rather one half of the pelvis; very accessible on the side where the occiput is, it seems wanting on the other side.

Diagnosis of the presentations of the breech. In these presentations the pelvic cavity is almost always empty, and the fœtal part which is lowest occupies the false pelvis, resting on the brim. Often it is inclined towards one of the iliac fossæ, which it fills. This fœtal part is bulky, but less spherical, less regular than the head. The head also gives out the ballottement more freely. Sometimes the head is so highly placed, that it is hidden under the xyphoid cartilage. The dorsal and abdominal aspects of the fœtus present the characters already described. But again, we must not neglect comparative observations of other parts.

Diagnosis of the trunk. In this presentation the flanks are occupied, one by the head, the other by the breech, and by palpation we recognise these parts by the characters described. The back is easily made out when directed forward; it cannot be felt when directed backward, but then the limbs are felt. The outline of the uterus also is altered; its long axis is

directed horizontally or obliquely, instead of perpendicularly to the pelvie brim.

Diagnosis of the positions by palpation. In making out the presentations we can hardly fail to make out the positions. The back and the vertebral column of course deelare the



Fig. 21.—Showing Diagnosis of Shoulder-presentation by Palpation. (After Pinard.)

direction taken by the occiput and the sacrum. In presentations of the face, it will be remembered that the chin looks to the right when the back is turned to the left side, and *vice versa*.

The Mechanism of Labour in head-first presentations.

We have seen in preceding sections that labour—if by this term is meant the passage of the child towards delivery—properly begins before the presenting part enters the pelvic brim.

¹ The application of palpation to diagnosis and the rectification of unfavourable positions is worked out with great clearness by Dr. Mundé (see his work, The Diagnosis and Treatment of Obstetric Cases by External Abdominal Examination and Manipulation, 1880).

There is a supra-pelvic stage. This has been sufficiently described in the section on Naegele's obliquity. It is enough to recal the fact that the presentation and position are greatly determined in this supra-pelvie stage by the lumbo-sacral curve and the posterior incline of the uterus.

Bearing this in mind, we may now take up the description of the mechanism of active labour at the point where it is

usually begun, namely, on the brim of the pelvis.

Head-first labour is typical of labour generally.

A. In the first position. The occiput is directed to the left foramen ovale or cotyloid cavity—that is, in Solayrès' obliquity; the head in its long diameter lies in an oblique diameter of the pelvis.

Six stages may be noted in the process ending in the extrusion of the child's body.

- 1. On the brim, or just dipping into the brim, the head is slightly flexed, chin upon chest, that is, in Ræderer's obliquity, head flexed upon its own body. This flexion or obliquity in normal conditions is at first very slight. At the same moment, the head is observed slightly inclined upon itself sideways—that is, in Naegele's obliquity—the child's ear which is in relation to the saeral promontory being nearer to its corresponding shoulder than is the case on the opposite or pubic side.
- 2. Engagement of the head in the pelvis and descent in the cavity.
- 3. Rotation of the head on its vertical axis during its progress.
- 4. Emergence of the head from the outlet, its disengagement and extension.
- 5. Rotation of the shoulders in the pelvis bringing restitution of the head.
 - 6. Expulsion of the trunk.

We will now follow these movements:—First stage. When labour begins the attitude of the fœtus is as depicted (fig. 22, p. 162).

The occiput is directed to the left ilium or foramen ovale. The long axis of the child generally coincides with the axis of the uterine cavity. Driving-force applied from the fundus of the uterus upon the breech is propagated along the child's spine and trunk to the neek and head. The head already

VOL. II. м somewhat flexed upon the chin, and the anterior part of the lower segment of the uterus offering less resistance than the posterior, the frontal or longer arm of the head-lever either remains stationary or rises relatively, whilst the occipital or short arm is thrust down into the pelvic brim. Thus we have the first stage, flexion. This is the beginning of the second stage, or engagement of head in pelvis. Two forces concur in directing the head in its descent. One is the inclined plane formed by the anterior wall of the lower segment of the uterus which directs the head backwards towards the pelvic floor, the other is the expanding cavity of the sacrum under the pro-



Fig. 22.—Presentation of Vertex in Right Oblique Diameter. 1st stage. Flexion. and Commencement of 2nd stage or Engagement in Pelvis. 1st position. (Pinard.) montory offering least resistance. Hence the head descends nearly to the pelvic floor with Naegele's obliquity rather increasing as the head revolves a little on its long axis to find accommodation where there is most space. At this stage the examining finger, passed centrally in the axis of the pelvis, impinges upon the right parietal protuberance, generally, in primiparæ almost constantly, capped by the lower segment—Bandl's segment—of the uterus. To reach the os uteri and to touch the head directly, the finger must pass further back or higher up nearer to the promontory.

Flexion and engagement of the head in the pelvis sometimes take place simultaneously; and in the case of primiparæ commonly before active labour sets in.

Third stage. Movement of rotation. During the descent of the head into the pelvis, the finger applied to the presenting part, takes note of a curious screw-like or spiral movement. Under the down-driving pressure, the occiput seems to come down and a little forward; when the uterus relaxes, a movement of restitution, or of rising and turning a little backwards, occurs. This is repeated until at last the presenting part gets under the pubic arch. Naegele contended that the part which first emerges under the pubic arch is not strictly the occiput. It certainly is not the central part of the occiput, but the upper and posterior angle of the parietal bone, and the adjacent part of the occipital—that is, the head does not emerge strictly with its long axis coincident with the external conjugate, but obliquely. It preserves, in short, a certain measure of the original obliquity-Solayrès' obliquity-with which it presented at the brim (see fig. 1, p. 23).

At what moment does the rotation-movement take place? We think this is not constant. In primiparæ the head may, as we have seen, get to the pelvic floor almost before active labour begins. In this case there is little or no rotation until the labour sets in. Under the driving-force the head is then compelled to adapt itself to the form of the parturient canal, especially of the pelvis, and so the occiput comes forward. Up to this time the head may have undergone little or no moulding; the liquor annii being still present, protects it. But the membranes bursting, the driving-force becomes more efficient, and as the head is compelled to advance, it bores its way, finding the route which affords the most room, adapting itself partly by moulding, and partly guided by the shape of the pelvic canal. The transverse diameter of the outlet and of near the outlet narrows, whilst the oblique and conjugate diameters expand, and thus the head-ovoid turns its longer diameters in these longer pelvic diameters -that is, the occiput comes forwards, whilst the forchead and face turn more to the sacral hollow. Tyler Smith, as we have seen, insisted that the sciatic spine was a main factor in directing the occiput forward. Tarnier explains that the rotation is determined by the unequal length of the two arms of the head-lever.

Fourth stage. Extension, deflexion, or disengagement. It is during this movement that the greatest amount of elongation by moulding takes place. The liquor amnii has commonly been discharged, and the plastic head having to traverse a tight musculo-tendinous ring, is exposed to the greatest amount of pressure. As the head engages in the outlet, the trunk engages in the pelvic cavity. The chin is still pressed upon the ehest when the presenting part gets under the pubic arch, even until the bregma appears at the posterior commissure of the vulva. At this moment the perinæum, acting like an elastic belt, on the one hand pushes the head up towards the pubes, and on the other slips quickly over the face, which it leaves bare, whilst it runs back towards the eoccyx. The occiput now being fixed under the pubic arch, on-driving force causes the anterior arm of the head-lever to descend—that is, to revolve round the pubic arch, causing the occiput to rise. This is extension, and marks the liberation of the head. It is a movement of rotation of the head on its transverse axis (see fig. 2, p. 24).

At the outlet the three obliquities of the head are still observed. Thus the part that emerges first under the pubic arch is not the middle of the occiput, but the posterior angle of the right parietal bone; the median point of the occiput lies to the left of the vulva, not centrally; and there is still some degree of flexion of chin upon chest.

5. Restitution or rotation of the expelled part on its long axis next takes place, in accordance with a similar rotation of the body still in the genital canal. The body, driven on by the uterine contractions, encounters different degrees of resistance on its anterior and posterior surface, and in consequence it rotates as it moves on. But this rotation of the body is not complete, for, as Schatz explains, the part of the body highest in the uterus keeps, in relation to the part which is lowest, about 30° behind. There results a torsion of the fruit-cylinder or whole length of the body, in which even the body of the uterus shares.

After the birth of the head, the shoulders adjusting themselves to the long diameter of the outlet, just as the head had

done, the effect is to turn the head, now liberated, round in the opposite direction—that is, the child's back being directed to the mother's left side, the face will look to the inside of the mother's right thigh.

The delivery of the shoulder is then effected under the continuing driving-force; and since the trunk is flexed in correspondence with the axis of the pelvis, the force will tell more upon the hinder part, increasing its convexity backwards, and therefore forcing the hinder shoulder downwards; the anterior shoulder, the right, gets under the pubic arch, and is relatively fixed, just as the occiput was; the hinder shoulder moving on along the perinæum is treated in the same manner as the face had been, and is gradually turned out of the vulva, sometimes first, but generally following the anterior or pubic shoulder. The chest then follows with its transverse diameter nearly corresponding to the conjugate of the pelvie outlet.

6. The birth of the breech follows under a new rotation of the long axis of the body, which brings the transverse axis of the breech into the left oblique diameter of the pelvis. There is rarely any difficulty in the transit of the breech. The passages have been fully distended by head and trunk. The breech is commonly aided in the delivery by the obstetrist, who draws lightly upon the shoulders and trunk.

B. The right occipito-anterior position. The description of the left occipito-anterior position applies to this, it being simply necessary to reverse the terms right for left. It involves no material difference in the course of the labour.

Moulding of head in head-first labours; occipito-anterior. The changes effected in these positions are as follows:—

The following diameters are shortened: the T.T., the S.B., and the F.M. In consequence the sub-occipito bregmatic circumference is reduced.

The following diameters are lengthened: O.F. and O.M.; and in consequence the occipito-frontal circumference is increased. The bi-mastoid diameter is constant. Generally, then, the transverse diameters are shortened, and the longitudinal diameters are lengthened.

Fig. 17, p. 132, showing these changes in a marked form, should be compared with fig. 16 of the ideal head. F.M. is increased to 5.25", the O.M. to 6.50". We have seen it

extended to 7.0". This is an extreme ease; but an elongation to 5.30" or 6.0" of the O.M. is by no means rare. These measurements come near to those commonly given as the normal.

The head undergoes a great part of its occipital clongation during the last stage—that is, when it is emerging under the



Fig. 23.—Braune's Frozen Section showing Left Occipito anterior position.

Head engaged in Pelvis. 2nd position.

oi. Os internum. oc. Os externum. r. Rectum.

pubic arch, and has to be moulded between this part and the vulva and perinæum and coccyx.

The occiput emerges first; the presenting part, as it parts the vulva, is near the posterior fontanelle. The effect of this is that the skull is gripped in sub-occipital-bregmatic diameter—that is, in the circumference of this diameter. At this part the skull exhibits marked plasticity, so that the on-driving force

causes the occiput to point more, and the occipito-frontal and occipito-mental are increased.

It is curious to observe how, under elongation, the angle of intersection of the O.F. and O.M. varies. The angle seems to be a measure of the elongation. Thus, looking at fig. 16 of normal head, the O.F. and O.M. form an angle of about 45°; whilst, looking at fig. 17, we see the two lines approaching coincidence forming an angle of 30° or less.

ADAPTATIONS OF PELVIS AND FŒTAL SKULL AND THEIR OBSTETRIC RELATIONS.

Adaptations of skull modified by moulding to successive planes of pelvis. Scale: inches.

PELVIS.			
Brim.		5	SKULL.
Conj. $4.25 - 4$	50, corresponds t	o bi-parietal,	3.75 - 4.00
Transv. 5.00-5.	25, ,,	{ O.F. S.B.	4.60 - 5.00
Obliq. 5.00,	"	₹S.B.	$4 \cdot 25 - 4 \cdot 50$
Carity.			
Conj. $4.75 - 5$	00, ,,	P.P.	3.75 - 3.50
Transv. 4.75,	"	O.F.	4.50 - 4.75
Obliq. 4.75-5:	25, ,,	S.B.	3.75 - 4.00
Outlet.			-
Conj. 4.25 - 5.	25, ,,	€ O.F. S.B.	4.75 - 5.25
Transv. 4.25,	,,	∖s.B.	3.75
Obliq. 4.25-4:	50, ,,	P.P.	3.50
		merging)	3.25 - 3.50
		into T.T.	

This table is no doubt open to criticism. There is no possibility of stating fixed or constant terms. Pelves and heads differ in proportion, in plasticity, and in other properties; but, allowing for variations, and something also for theoretical assumption, this table conveys much useful information and suggestion. In appreciating it the following points will be borne in mind. The correspondence of feetal and pelvic diameters are approximate only. The long diameters of the head are rarely opposed to the diameters of the pelvis. The head traverses somewhat axially—that is, the long axis of the head-ovoid inclines to coincidence with the axis of the pelvic canal. To a less marked degree, but still appreciably, the extreme transverse diameters of the head also avoid direct apposition to the pelvic diameters. The head enters, and traverses somewhat canted or slewed.

Under the helicine progression of the head the relations undergo partial changes.

C. Occipito-posterior positions. There is equally elongation of the occiput; but there is greater depression or flattening of the region round the anterior fontanelle.

The course of labour with occipito-posterior position presents features distinct from that of labour with the occiput anterior.

There are two occipito-posterior positions: R 3, numbered consecutively from 1 and 2, the occipito-anterior. In this the

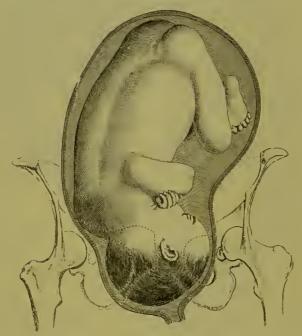


Fig. 24.—Presentation of Vertex in left Oblique Diameter, Occipito Anterior. 2nd position. (Pinard.)

occiput is directed to the right sacro-iliac synchrondrosis; the long diameter of the head, therefore, lies in the right oblique diameter of the pelvis, and is the reverse of the first position.

According to our experience the occipito-posterior positions are more frequent when the promontory is comparatively flattened. Under this condition the occiput tends more readily to turn backwards as it descends. We have known this position recur in the entire series of labours of the same woman; so that, having occurred in a first labour, it may be expected to recur in subsequent labours. The general effect is that the labour is

rendered more tedious; it more frequently calls for aid by forceps.

A remarkable phenomenon is the strong tendency the occipito-posterior positions manifest to be converted into occipito-anterior positions as labour advances. In the case of the third position, now under study, this tendency is so great that Naegele affirms that it is at an early stage more frequent than is the second position; and that a large proportion of apparent second positions began as third positions.

This tendency of the occiput to come forwards is one instance

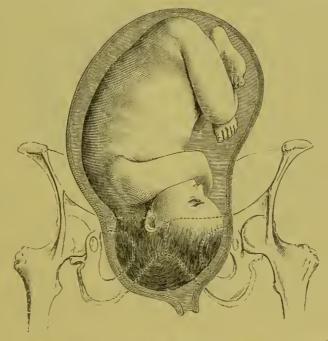


Fig. 25.—Presentation of Vertex in Right Oblique Diameter, Occipito-Posterior. 3rd position. (Pinard.)

of the general law which tends to compel the dorsum of the child to turn forwards. It rules in breech- and shoulder-presentations. It is a result of that law by which Robert Barnes explains the production of the ordinary position of the fœtus in utero before labour—namely, the more easy adaptation of the concave and yielding anterior aspect of the body to the resisting convexity of the spinal column. Thus we see that when this spinal convexity is slight, the occiput more easily glides backwards.

It is convenient to premise some general phenomena common to both the occipito-posterior positions. First, as we have seen, both tried to pass into the nearest occipito-anterior position. Secondly, the original occipito-posterior position may persist to the end of labour.

We need not dwell upon the first case, since being resolved into the anterior occipital positions, the history becomes that of the positions into which they are resolved. It need only be noted that this conversion takes place, in many eases, when the vault of the cranium has reached the floor of the pelvis. The factors which determine this rotation are complex. The oeciput, descending, meets the spine of the right ischium and the attached ligaments, when instead of passing behind this prominence, it passes in front of it, and, directed by the ischiatic planes, passes downwards and forwards, until it occupies the second position. We believe an important factor is the action of the psoas-iliacal muscle of the side in relation to the occiput; this, bellying out under the reflex-voluntary eontraction of the expulsive stage, will push the broad expanse of the occiput forward, and thrust it within the range of the ischiatie planes.

Some experiments of Dubois in relation to this phenomenon are especially interesting. A woman died in childbed; the uterus, of large size, was opened down to the cervix, and held in a suitable position over the pelvic brim; the fœtus was then placed in the right occipito-posterior position. The fœtus then, pushed from above, readily entered the cavity of the pelvis; much greater effort was necessary to make the head roll over the perinæum and clear the vulva; but, in three successive attempts, when the head had traversed the internal genital organs, the occiput had turned to the right anterior position, the face having turned to the left and backwards; that is, rotation had taken place as in natural labour. Subsequent experiments showed that when the perinæum and vulva had lost their firmness, the rotation forward did not take place.

This observation is in entire accordance with what we have described as the action of the pelvic floor, or perineal valve. This forms an inclined plane, guiding the presenting part under the pubic arch.

When the occiput retains its posterior position, it tends to roll up under the promontory, adapting its convexity to the sacral hollow. This involves a degree of rotation on its transverse axis, so that the forehead descends behind the opposite foramen ovale. This extension of the head brings its long diameters into unfavourable relation with the diameters of the pelvis. The extension of the head, occiput turning up under the promontory, is analogous to the natural extension of the occiput under the pubes. But in occipito-posterior position, the occiput can hardly escape from the pelvis. It becomes lodged in the hollow of the sacrum and on the floor of the pelvis, and driving-force acting in greater degree upon the anterior arm of the head-lever tends to increase the difficulty.



Fig. 26.—Vertex in Left Oblique Diameter, Occipito-Postericr. 4th position. (Pinard.)

After a time, however, the three factors of labour under mutual adaptation may effect delivery, the occipito-posterior position being preserved. The driving-force continues—the soft resisting parts of the parturient canal yield; the head moulds. Thus, gradually, the forchead gets under the pubic arch, and a little more space is gained for the long diameter of the head; the forehead then becoming more fixed serves as a fulcrum to the rod represented by the long diameter of the head; the occiput then feels the preponderant force of the driving-power; it descends, distends the pelvic floor and perinæum, and at last

emerges. As soon as the equator of the head, sometimes even earlier, has passed the vulva, flexion eeases, extension begins, and the nose, mouth, and ehin successively appear, the occiput rolls back over the perinæum. In this process the perinæum undergoes exeessive distension. Thus laceration of this structure is more frequent than in occipito-anterior positions.

D. The fourth position, we have seen, occupies the same relation to the first that the third does to the second. It evinces the like tendency to be converted into the first, and by a similar mechanism.

Tyler Smith observes that in the first and third positions, the most common, the head occupies the right oblique diameter of the pelvis. He submits that the greater frequency of the right oblique positions is due to the occupation of the posterior part of the left oblique diameter by the rectum. The bulging of this organ may be enough to deflect the occiput or sinciput to the right.

We have noted the spiral or screw-like rotation of the head. Tyler Smith describes this with his usual felicity. The pelvis, he says, represents a portion of a female screw, admitting a male screw (the fœtal head). But the male and female screws are not accurately adjusted at all points. It is only at the points where the posterior part of the parietal bone or of the occiput comes in contact with the planes of the isehium and pubes that the thread of the male screw bites, as it were, the thread of the female screw. It is here that the spiral direction is impressed upon the fœtal eranium. The line of this portion of the spiral may be made out by chalking the salient point of the fœtal head, and moving it through the pelvis in the direction it takes in parturition.

The two halves of the pelvis also represent portions of two screws, the inclined planes of which are arranged in opposite directions. Thus, if the head be placed in the second position, the spiral movement is reversed from that which obtains in the first position, and the long diameter of the feetal cranium moves from the transverse, or left oblique, to the antero-posterior diameter. In the ease of labour occurring in the first, the right shoulder moves upon the right portion of the spiral or serew, formed by the right ischium and pelvic bone, and glides down it, just as the head does in the second position. In the second

position, on the contrary, after the delivery of the head, the left shoulder rotates upon the planes of the screw or spiral of the left side of the pelvis, and passes out with a movement similar to that which belongs to the head in the first position.

Perhaps, continues Tyler Smith, the screw or spiral movement is seen still more distinctly in the common terminations of the third and fourth positions. Here, rather more than one-fourth of a circle is completed in the movement which brings the occiput from the right or left sacro-iliac joint to the right or left ramus of the pubic arch.

Other positions of the head are sometimes described. Thus we may have a right and a left transverse position, according as the occiput is supposed to be directed to the right or left ilium. That these positions occur there is no doubt, but they are almost invariably transitory, soon merging into one or other oblique position. It has been said further that the head may present with its occipito-frontal diameter in the conjugate diameter of the pelvis. This position can hardly occur, or be maintained in a normal pelvis, the head being of normal size. If the child be premature, very small, or dead, the head may present in this or in any other way; or it may occur in the kyphotic pelvis. But such cases do not fall under the mechanism of normal labour.

Summary of Mechanism of Labour in Head-presentations.

Vertex-presenting. Six stages: 1. Flexion; 2. Engagement or descent in pelvis; 3. Rotation; 4. Disengagement or extension; 5. Rotation of shoulders with restitution of head; 6. Expulsion of trunk.

Four first stages apply to head, two last to trunk.

- 1. Flexion, chin flexed upon chest.
- 2. Descent of head in pelvis.
- 3. Rotation, occiput coming forward as head descends near floor of pelvis.
- 4. Extension, progression, and liberation, movement round symphysis pubis in Carus's curve or axis of pelvis.
- 5. Interior rotation of shoulders and trunk, exterior rotation of head, restitution.

6. Liberation of the trunk, progression of shoulders and trunk in Carus's curve.

Under Pajot's law of accommodation, presenting part undergoes successive changes of shape and position, in relation to the pelvic canal.

Dilatation of cervix uteri. 'Canalisation' of parturient passages.

Stretching of floor of pelvis. Dilatation of vulva.

During 2nd, 3rd, and 4th stages, head undergoes moulding in adaptation to pelvic and utero-vaginal canals.

There is a definite position of head for each plane of the pelvis. The head follows a screw movement.

Mechanism of Face-presentations.

Face-presentations occupy a doubtful or intermediate place between normal or propitious, and abnormal or unpropitious labours.

A considerable proportion terminate happily for mother and child under spontaneous labour. But the labour is commonly tedious, protracted, and not seldom calls for artificial aid, and brings the child and mother into danger.

Let us take in the first place the two mento-posterior positions. Of these we will first trace the mechanism observed in the right mento-posterior position, which is the natural outcome of the first or right occipito-anterior position.

How produced. The theories put forward are various and conflicting. Hecker submitted that it was due to extreme pre-existing elongation of the head, the dolico-cephalic head. This theory, we believe, rests upon defective observation and erroneous interpretation of facts. The shape of the head invoked as the cause of the face-presentation is in reality the effect of the labour in this presentation. Hecker supposes that the increased power of the occipital arm of the lever throws the face down. From photographs and outline tracings of heads born after face and other varieties of labour, we are in a position to demonstrate Hecker's error. It is true that in face-labours the head is found elongated; but it is easy to trace this altered form to the compression undergone during labour. There is no evidence to show that it exists before labour. Fig. 1, p. 23, shows

the common globular shape of the head before labour. Fig. 24, taken from a photograph of an actual case, represents the dolico-eephalic condition produced during its compression in its transit through the pelvis.

Brow-presentations may be regarded as transitional between vertex- and face-presentations; and by analysing the mode in which brow- and face-presentations arise, we shall have the best indications for prevention and treatment. Let us consider the head as a lever of the third order, the power acting about the middle. The fronto-occipital diameter or axis represents the lever; the atlanto-occipital articulation is the seat of the power. Riding upon this point, the head moves in seesaw backwards and forwards. A force too little noticed in obstetrics is friction. If friction were uniform at all points of the circumference of the head, it would be of minor importance, from a purely dynamic point of view, to regard it. But it is rarely so. Friction at one point of the head may be so much greater than elsewhere, that the head at the point of greatest resistance is retarded, whilst at the opposite point the head will advance to a greater extent. The head then must change its position in relation to the pelvis. Let us then take the ease where excess of friction bears upon the occiput when in relation with the left foramen ovale. This point will be relatively fixed, whilst the opposite point or forehead, receiving the full impact of the force propagated through the spine to the atlanto-occipital hinge, will descend—that is, the forehead will take the place of the vertex, and be the presenting part. If this process be eontinued, the head rotating back more and more upon its transverse axis, the face succeeds to the forehead.

A condition that singularly favours this excess of occipital friction, and consequent rotation in extension, is the lateral obliquity of the uterus. The want of coincidence between the axis of the uterus and child, and of the axis of the pelvic brim, disturbs the equilibrium of resistance and friction. Thus we see that the production of face-presentations is due to the operation of the same mechanical law as that which produces Naegele's obliquity of the head. In both cases there is angular relation of the axis of the uterus and fætus to the axis of the pelvic brim, and therefore unequal resistance, and therefore greater descent of that part of the head to which the least

resistance is opposed—that is, there is produced obliquity of the head, on its occipito-frontal diameter in Naegele's obliquity, on its bi-parietal diameter in the case of face-presentation or obliquity.

This demonstration is further proved by its application to practice in rectifying the vicious position. If we can transpose the greatest friction or resistance to the forehead, and still maintain the driving-force, it is clear that the occiput must descend, and the normal condition may be restored. In practice this is actually done. When at an early stage of

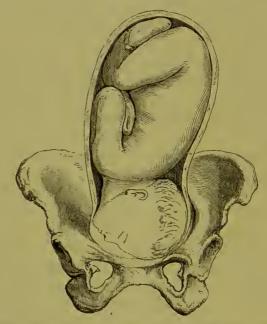


Fig. 27.-Face-presentation in the First Position at the Brim. Mento-Posterior.

labour we find the forehead presenting, we can, by applying the tips of two fingers to the forehead, retard its descent, and the occiput comes down. This effected, the rest will probably go on naturally, because the atlanto-occipital joint being somewhat nearer the occipital than the frontal end of the lever, the shorter or occipital arm will keep lowest. But if there should still be excess of resistance at the occipital end, we have only to add so much resistance to the frontal end as will maintain the lower in equilibrium.

It is at the same time desirable to restore the due relations between the axis of the uterus and the axis of the pelvis. This is best done by placing the patient on her back and supporting the uterus in the median line by the hands.

It is also possible by timely adjustment and support of the uterus before the advent of labour to correct the tendency to malposition of the child and thus to avert face-presentation.

As in the case of the cranial presentation, there are four positions, and these may be described as conversions or accidental departures from the respective cranial positions. Thus, taking the first cranial position, in which the occiput is directed to the left foramen ovale: the occiput, instead of descending

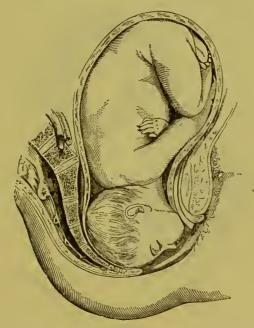


Fig. 28.—Rotation forwards of the Chin. (After Tyler Smith.)

into the pelvic cavity, hitches upon the edge of the brim, or is kept up from some other cause, whilst the driving-force continuing, the head rotates on its transverse axis, and the forehead and face successively come lowermost. Thus is formed the first face-position. The second face-position is formed in a precisely similar manner, the forehead coming to the right foramen ovale, and the fronto-mental line of the face lying in the second or left oblique diameter of the pelvis. The third and fourth face-positions may in like manner be traced to the third and fourth eranial positions. In all the cases the forehead takes the place of, and represents, the occiput.

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Progress of face-presentations. In the position described the head might very well proceed through the pelvic eavity and outlet, following corresponding rotations to those observed in cranial positions, if the head only had to travel. But the child's trunk must follow; and it is this which causes the difficulty, and which compels a change. The student's attention to this point is especially invited, because the too common mode of teaching and examination in the mechanism of labour in this country is to use simply a pelvis and skull; and thus he is apt to neglect the part which the body plays in this case.



Fig. 29.—Passage of the Head through the External Parts in Face-presentations.
(After Tyler Smith.)

The head is becoming flexed and sweeping over the perinæum.

Reference to fig. 30 will place the difficulty clearly before the mind's eye and show what it is that has to be overcome by

nature or by art.

We see, then, that the head, rolled back in extreme extension, is pressed down upon the back between the shoulders (see fig. 30). Thus there is opposed to the pelvie diameter not alone the fronto-oecipital diameters of the child's head, but, in addition, the thickness of its chest. The sum of these two exceeds the capacity of the pelvis. This is made more evident by the triangle traced in the diagram. A B is the fronto-mental diameter;

AC and BC, the two other sides of the triangle, represent the relative dimensions of the body which has to pass; A thus is the wedge, BC the base of the triangle. The wedge cannot proceed, because the base greatly exceeds the available space. Here, then, is the difficulty. Unless the relations of the factors of the problem be changed, the head will become locked, labour comes to a standstill, the fœtus may perish of asphyxia, and the mother of exhaustion or rupture of the uterus. Let us see how Nature extricates herself.

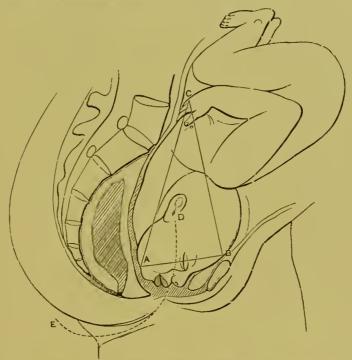


Fig. 30.—Showing Face-presentation (mento-posterior) engaged in Pelvis, and Elongation of Head. (Robert Barnes.)

A, B, C. Wedge formed by head and chest. A. Apex of wedge.

Three following events are possible:-

- 1. The head and trunk may undergo such moulding under long compression that the base of the wedge may be so far lessened as to permit of onward progression. But this event, rare in any case, can hardly happen unless the child be very small in proportion to the pelvis, or dead, in which latter case it may be crushed down to adaptation.
- 2. The wedge formed by head and trunk may be decomposed—that is, the occiput, quitting the relation of extreme extension, may descend, and, flexion being restored, the head is brought

into natural relation to the axis of the child's body. This decomposition may be effected in two ways:—

The body and head rotating, the chin comes round to the pubes, and there getting under the arch, space is gained behind in which the occiput can descend. Flexion proceeds. The wedge is decomposed. This is the most frequent natural termination.

3. The wedge penetrates some distance into the pelvic cavity, the child undergoing greater compression, and probably perishing in the process. The chin does not come forward to the shallow pubic side of the pelvis, so as to be liberated, but, maintaining its posterior position, puts the perinæum and pelvic floor enormously on the stretch, until at last the chin rides over the fourchette and coccyx, then the wedge gets decomposed by the occiput descending, flexion being restored. In the first case, that in which the chin comes forward, the chin or lower jaw, comparatively fixed under the pubic arch, forms the centre of evolution of the head; the face, forehead, vault of cranium and occiput successively emerge in Carus's curve; thus we have a counterpart of the course of labour in occipito-anterior positions. In the second case, the chin or lower jaw, escaping over the fourchette, becomes comparatively fixed under the coccyx, which now represents the centre of evolution; and the face, forehead, vault of cranium and occiput, following the curve DE (fig. 30), successively emerge backwards: flexion being thus restored, and the wedge decomposed, the difficulty is overcome.

We thus find a third curve to add to Barnes's curve—the promontorial, and to Carus's curve—the pubic. This third or perinæal curve has lately attracted special attention in connection with the study of axis-traction and the usc of Aveling's and Tarnier's forceps.

We may now trace the successive steps of the rotation chin forwards. We must begin by warning the student not to accept his idea from a favourite diagram of Schultze, copied into most recent text-books. We may take as the type the first or most frequent face-position—mento-posterior in the right oblique diameter of the pelvis. In this case, at the beginning of labour extension of the head or descent of the face is in progress. This may take place before the membranes are ruptured. On examin-

ation the presenting part is more difficult to reach than in ordinary cranial positions; the brim of the pelvis is not so well filled; the lower segment of the uterus is not so expanded; the finger passed through the os uteri, instead of feeling the broad, firm expanse of the cranial vault and a fontanelle, feels an irregular surface which, under more searching, is resolved into nose, mouth, and chin. At this stage the fronto-mental diameter may approach the transverse diameter of the pelvis.

The root of the nose crosses the os uteri exactly in the same manner as the sagittal suture does in the corresponding cranial position. The right eye and zygoma is that part of the face which is lowest in the pelvis. This is the part touched by the finger in examining. It represents the right parietal protuberance of the first cranial position. It is upon this part that the analogue of the capnt succedaneum, the swelling, forms. This part is the first that presses through the os externum. As descent continues, extension increases; the chin gets lower, and represents the apex of the wedge; as the base of the wedge tries to engage in the pelvic brim, the occiput is driven into the back, and, under a process of flattening of the cranial vault along the vertex, the laryngo-bregmatic diameter is lessened; the chest at the same time is lessened in its antero-posterior diameter; and thus the base of the wedge may be so far moulded that it can descend some way into the cavity. When it has descended as far as the mechanical obstacle will allow—and this is sometimes nearly to the floor of the pelvis—the process of accommodation by rotation sets in.

The chin comes forward under the right branch of the pubic arch, the face during the whole process preserving a strictly oblique position both as to the transverse diameter, and the axis of the pelvis. The forces, static and active, which determine this rotation, are assumed to be the same as those which determine the anterior screw rotation of the occiput in cranial positions. But we believe that the principal guiding movement is effected nearer to or at the brim of the pelvis. The base of the wedge formed by head and chest under the driving-force is turned round, and necessarily the face turns round with it. If we adopt absolutely the intra-pelvic origin of the rotation, we must imagine either that the head is twisted on its neck changing its relation to its chest—a circumstance

hard to realise when we remember how tightly the parts are jammed—or we must imagine that the movement began at the chin or face, the point of the wedge being powerful enough to eause the whole wedge to rotate. It seems to us more reasonable to eonclude that the maximum moving power resides in the larger part of the body, that is, in the base of the wedge rather than in its apex.

The second position of the face is merely the reverse of the first. It is now the left side which is turned forwards, the left eye and zygomatic process being lowest in the pelvis; the chin is turned to the left side, and advances to the left foramen ovale and left branch of the pubic arch. The left check first enters the os externum and presents the swelling. The chin passes under the left branch of the pubic arch.

In the third and fourth positions, or the mento-anterior, it will be noted that the chin is already nearer to the pubic arch, and has consequently a much shorter distance to travel in its rotation towards liberation, than is the case with the mentoposterior positions. In the mento-anterior positions the chin only traverses about the eighth of the pelvie circle, whereas the mento-posterior chin has to travel about one-fourth of the circle or twice the distance. This is one cause of the greater ease with which labour is accomplished in the mento-anterior positions. Another favourable condition is that the trunk more easily adapts itself against the yielding 'abdominal wall, so that the wedging is less firm. But in truth the mento-anterior positions are comparatively rare. This will be understood when we remember that they are the outcome of occipito-posterior positions, themselves comparatively rare. We are not for this reason to conclude that the liberation of the head by the forward rotation of the chin is a very serious difficulty. It takes place in the great majority of instances perfectly well, if let alone. It is a ease in which it may be said that Nature abhors assistance.

Summary of mechanism of face presentations.

A. Mento-anterior positions.

1st stage. Extension of head, occiput fixed, face descending.

2. Engagement or descent of head into pelvis.

3. Rotation of head, ehin coming forwards.

- 4. Disengagement or liberation of head.
- 5. Interior rotation of trunk.
- 6. Expulsion of the trunk.
- B. Mento-posterior positions.
 - 1. Extension of head.
 - 2. Engagement or descent of head into pelvis.
 - 3. Rotation of head. { 1. Chin coming forwards.
 2. Chin moving more backwards.
 - 4. Disengagement or liberation of head.
 - 1. Chin under pubes.
 - 2. Chin under coccyx.
 - 5. Interior rotation of trunk.
 - 6. Expulsion of trunk.

Management of face-presentations. - Now that the sufficiency of Nature is recognised, operative interference is much restricted. It is eminently a case for patience. Turning was at one time much resorted to. This operation can hardly be carried out with safety when the labour is advanced, when the presenting parts are jammed in the pelvic cavity. And if practised early in labour, when the face is at the brim, no opportunity is given for Nature to do her work. Here, as in many other cases, premature interference actually confirms the presumption of ignorance, by shutting out that knowledge which comes from the observation of Nature. By waiting, we might see the chin come forward. The questions arise: 1. Can we usefully convert a face-presentation into its originacranial presentation? 2. Failing this conversion, can we promote the forward chin-rotation? 3. Is there a residuum of cases in which the chin will neither come forward, nor effect its liberation by getting over the perinæum and coccyx?

1. The first question, that of the expediency of restoring the original cranial presentation by bringing down the occiput, has been referred to as the most seemingly rational proceeding. If we could transpose the greatest resistance to the anterior pole of the fœtal head, the occiput would, supposing the continuance of adequate driving-force, come down before the face. The difficulty would be averted. Such a proceeding could only be carried out at an early stage, that is, before the face-position is completed; and at this stage, the imperfect dilatation of the lower segment of the uterus and of the cervix will oppose an

almost insurmountable obstacle. But Dr. John Clarke believed that the position could be rectified by manipulation at a later stage. He waited until the head had descended into the cavity of the pelvis, and then exerting steady pressure upwards and backwards upon the presenting cheek during each pain, he succeeded in lodging the face in the hollow of the sacrum. Thus he said the labour would terminate as in vertex cases. We have tried this method, using as much pressure as we thought justifiable, without accomplishing the object. may say that considerable force would be necessary, more than can safely be employed, to decompose the wedge in this way. Baudelocque advised another proceeding. The hand was carried through the os uteri, into the space between the brim of the pelvis and the forehead of the fœtus; the membranes were then ruptured, and the fingers seizing the vault and then the occiput of the child, the attempt was made to bring down the occiput, and thus to substitute a cranial position. The proceeding is violent,—difficult, when not impossible, to carry out, likely to excite dangerous contractions of the uterus, extremely likely to favour the descent of the cord; and, above all, it is superfluous. Similar attempts have been made to bring down the occiput by help of the lever. This is open to similar objections. We conclude then that it is wiser not to attempt the restitution to a cranial position.

- 2. We come next to the second question, that of the expediency of helping the chin forward in the path indicated by Nature. Some good may be done in this way. A finger may sometimes be passed into the child's mouth, and gentle traction made towards the pubic arch during the pains. Very little force à fronte thus added to the driving-force may give the desired advance.
- 3. The third question is how to deal with the residual case in which Nature is unequal to complete her task. This question, we have seen, can hardly arise until the labour has made some progress; therefore we assume that we have to deal with cases in which the face is low in the pelvic cavity, and arrest or impaction has occurred. This may arise as in cranial positions from the inertia of exhaustion from disproportion.

Should the labour be arrested when the chin is in course of rotation forwards, the forceps may be usefully applied. The

mode of doing this will be described in the part specially devoted to operations. We need only say here, that the head must be well seized over the hinder part, and traction made downwards and forwards. When there is arrest, the chin remaining posterior, it is sometimes sufficient to put on a little vis à fronte by forceps, in the same way as in the preceding case. As onward movement is imparted, the chin may come forwards as it does under the natural vis à tergo. But if this be not observed, the chin should be brought over the perinæum and coccyx, as occurs sometimes under the natural efforts. This we have successfully carried out.

There are still cases in which exhaustion, arrest, perhaps impaction of the child, dictate a severer course. The urgency may compel us to resort to craniotomy. By this proceeding, the difficulty is met by reducing the bulk of the wedge; and it also becomes easier to decompose the wedge, altering the position of the head-element. But this, the ultimate resource, is rarely necessary.

At one time it was a general practice to turn in facepresentations. To accomplish this, the operation must be
undertaken before the head has descended into the pelvic
brim, and, at this stage, the presumption is still strongly in
favour of the sufficiency of nature—that is, the operation is
uncalled for. On the other hand, when the head and chestwedge have got impacted in the pelvis, the operation is so
difficult as to entail serious danger to the mother, without
giving reasonable expectation of saving the child. The cases
that justify turning, then, are exceptional.

When the head is born, the rest of the body behaves as

When the head is born, the rest of the body behaves as in cranial presentations. The right shoulder, being lowest, is driven against the anterior surface of the spine of the right ischium, and rotated from right to left, so as to place the shoulder nearly in the antero-posterior diameter of the outlet of the pelvis. The right shoulder is thus born first, the left sweeps over the perinæum. The hips foliow in like manner.

sweeps over the perinæum. The hips foliow in like manner.

The aspect of the child born under face-presentation attracts special attention. The livid swelling over the presenting parts gives it a frightful appearance, causing, perhaps, a shock to the assistants, and suggesting to the ignorant the suspicion that it was injured by the obstetrist.

A charge of malapraxis might, in ignorance or malice, be based upon this natural phenomenon. The swelling has for its centre, commonly, the malar bone that was lowest; hence it spreads over the nose and eye, the lid may be enormously swollen, reminding one of a black eye from a pugilistic encounter. The mouth is involved in the swelling, the lips being large and livid. This is especially the case when delivery is effected chin-posteriorly. Some idea of this may be acquired from fig. 30, taken from an actual case. The swelling forming more on one side, by distorting the features, makes the general appearance more hideous.

Fortunately, the swelling quickly subsides. In the course of three or four days little remains to be seen, beyond a little discolouration from ecchymosis. Fomentations with warm water constitute the treatment.

The deformation of the cranium bears most upon the vertex. This part is depressed against the symphysis pubis; bulging of the occiput ensues. The general appearance is represented in fig. 30.

Children born dead from the compression the head has undergone during labour, have exhibited marks of cerebral congestion. This was found in several cases by Chaussier and by Naegele. The singular and great deformation of the skull produced in these cases must almost necessarily entail some injury to the brain.

The immediate effect of face-labour upon the mother is the greater risk of laceration of the perinæum; and the greater friction involves greater bruising of the parturient canal. These traumatic injuries, added to the exhaustion of protracted labour upon the woman, expose her to more risk of puerperal complications. Still the ultimate result is hardly more serious than that of normal cranial labour. Experience justifies Boer's dictum, uttered in 1793, that face-presentations, being merely a rarer form of natural labour, should be left to the natural efforts, since neither the mothers nor the children were exposed to any more danger than in ordinary labour. He says that, of 80 cases which he himself observed, three, or at most four, of the children were born dead. None of the mothers suffered, yet all were left to Nature.

This instructive quotation fitly sums up the history of facelabours.

Forehead-presentations. These are intermediate, between cranial and face-presentations. We may suppose the progress towards a face-presentation to stop half-way; the rotation of the skull on its transverse diameter ceases when the forehead is over the brim. In this position one of three things may happen: 1. The position may be nearly preserved. 2. The rotation occiput backwards may continue, and a complete face-presentation may result; or 3. The rotation may be reversed, and the cranial position may be regained.

Under this theory of forehead-presentation being a stage towards face-presentation, we find four corresponding foreheadpresentations, the head occupying one or other oblique diameter, and being either anterior or posterior.

In our experience forehead-presentation is especially liable to occur in pelves approaching to the kyphotic type, in which the sacral promontory juts less than usual. In such cases the forehead may lie close behind the symphysis pubis, the position being in the conjugate diameter.

The cases in which the forehead is anterior—and they are the most common—resemble in some respects the occipito-posterior positions of the cranium. Similar treatment is indicated. It is sometimes described as 'face to pubes.' The forehead taking a point d'appui against the symphysis, the indication is to bring down the occiput. This is done by applying the long forceps, one blade over each ear, and then making traction in Carus' curve, at first well backwards, then, as the occiput descends, carrying the handles well forwards.

Presentations of the Pelvic Extremity.

Presentations of the pelvic end of the long axis of the fœtal body coinciding with the axis of the parturient canal fall under the conditions of natural labour. Labour may be completed by the natural forces with safety to mother and child. The dynamics ruling in head and face presentations rule here. The law of accommodation is equally evident in its operation.

Frequency. Pinard found that in mature births the

proportion of breech-presentations was 1 in 62. Perhaps 1 in 80 is the rule.

Causes. In the first place we may note that the attitude of the fœtus as regards the disposition of its limbs is commonly the same as when the head presents. The difference is that, instead of the head being lowermost, the breech is lowermost. The attitudes are correctly given in figs. 31, 32 after Ramsbotham. There is the same general condition of flexion—head upon chest, spine curved forwards, arms and hands flexed upon



Fig. 31.—Showing Dorso-Anterior Position of Breech. (After Ramsbotham.)

themselves and upon the chest, legs flexed upon thighs, thighs flexed upon abdomen. The general result is that the child is packed in the least space, and forms an ovoid.

Such is the usual and normal attitude; but most text-books continue to reproduce as the type of breech-attitudes a diagram which represents the legs in extension, so that the toes touch the shoulders. This attitude is exceptional, and gives rise, as we shall see, to very difficult labour, commonly compelling resort to a difficult operation to effect delivery.

The conditions that favour breech-presentation are: Excess of liquor annii, so that the fœtus, whilst relatively small, may revolve in utero; laxity of the uterine walls and abdominal walls; multiple, especially twin pregnancies, the fœtuses, accommodating themselves in the containing space so as to occupy the least room, will usually be disposed so that one has its head lowest in relation to the other's breech. Now



Fig. 32.—Showing Abdomino-Anterior Position of Breech. (After Ramsbotham.)

when the head-presenting fœtus is born, its fellow will present by the breech. This is a simple matter of mutual accommodation. Then there are obliquity of the uterus; jutting promontory of the sacrum; implantation of the placenta in the lower segment of the uterus.

Under excess of liquor amnii and lax condition of the uterus and abdominal walls the fœtus easily changes its position. The

researches of Wigand, D'Outrepont, Credé, Hecker, Valenta, and especially of Esterlè,¹ prove that the fœtus frequently undergoes spontaneous changes of position; also that the position may be changed with great facility in the latter months by external manipulation. It is not difficult to understand that the fœtus may change from head to breech under external impressions more or less accidental. Women encounter shocks, succussions, pressure on the abdomen and uterus from various forms of exertion, from stays which press unduly on the fundus uteri, and direct pressure under coitus, which, the fœtus being unusually mobile, may cause it to revolve. If we imagine an original head-presentation existing in the eighth month of

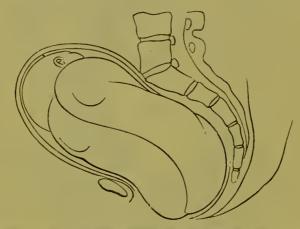


Fig. 33.—Showing Dorso-Anterior Breech-position nates near outlet. Trunk curved, corresponding with Parturient Canal.

gestation, liquor amnii in excess, and the uterus deflected, say, as is not unusual, to the right, apply pressure continuously or in a series of succussions to the lower pole of the uterus so as to bear upon the head, the head will rise, the breech will in equal degree descend. If the moving impulse be discontinued before the head has risen above the equator of the uterus, it may descend and right itself, or it may remain in the iliac fossa, the shoulder coming over the pelvic brim, constituting a shoulder or so-called transverse-presentation. But if the head has been pushed up above the equator of the uterus, even when the pressure is withdrawn the head will hardly descend to its original place. The lever formed by the child's body is now grasped by

^{1 &#}x27;Sul rivolgimento esterno,' Annali Universali di Medicina, 1859.

the uterus, naturally of an ovoid form, and constantly tending, after interference, to recover this form in such a way that the head-arm of the lever is earried higher up, and the breech-arm lower down, accommodation between the fœtal ovoid being thus re-established, substituting a breech for a head-presentation.

The force acting is twofold: 1. The restitution-force inherent

The force acting is twofold: 1. The restitution-force inherent in the uterus, which constantly tends to regain its natural ovoid shape after distension; this is due to elasticity or resiliency of tissue, which may be compared to the action of an india-rubber bottle after distension. 2. To active muscular contraction, which again tends to restore the ovoid shape.

Another condition we have observed is the implantation of the placenta upon one side of the lower segment of the uterus. An inclined plane is thus formed along which the feetal head and shoulder are guided across to the opposite side of the pelvis. If the process stop short at the shoulder, we have a transverse presentation; if it go to lift the head above the equator of the uterus, the breech will be carried to the fundus of the uterus.

Positions. As in cranial and face-presentations, we may describe four positions of the breech; and these may be divided into two dorso-anterior and two dorso-posterior.

The abdomino-anterior positions. The first is that which arises out of the first cranial position, L.A.A.P., in the way described (page 154). We will trace its progress through the pelvis. Referring to the diagram, we observe that the bitrochanteric diameter of the breech lies in the left oblique diameter of the pelvis abdomen-anterior. The breech represents the head. The side nearest to the promontory meeting more resistance, and the axis of uterus and fœtus lying behind the axis of the pelvie brim, there is necessarily obliquity of the breech, analogous to Naegele's obliquity of the head. Thus the anterior or right ischium stands lowest in the pelvis, just as the anterior parietal bone does in the cranial presentation. Driving-force impelling progress, the breech engages in the pelvic cavity, revolving round and under the promontory in Barnes's curve, and continuing in the same position nearly to the floor of the pelvis. Then, encountering the same conditions which cause the rotation of the head in a helicine course, bringing the occiput forward, the anterior ischium comes a little

forward under the pubic arch and presses against it; the other ischium, which has to make a greater circuit in Carus's curve, passes forwards over the strongly-distended perinæum, so that when the breech is born the abdomen of the child will be directed to the inner and posterior surface of the mother's left thigh. It must not, however, be supposed that rotation takes place to an equal extent as in cranial presentations. The breech preserves more of its original obliquity to the end. Naegele insisted much upon this. Two other conditions call for description. One is the 'balling' or moulding of the breech; the component parts of the breech are yielding, and, under compression, undergo concentric moulding—a process for which we suggest the word 'balling' as appropriate. The other condition is the serpentine figure imparted to the long axis of the child to fit it to the parturient curve (see fig. 33.)

The rest of the trunk follows in this position, and as the breast approaches the outlet the shoulders press through the brim in the same or left oblique diameter as that into which the breech entered. Then the head, resting in flexion upon the chest, passes the brim in the right oblique diameter, the occiput directed to the right sacro-iliac joint. Then the head, descending into the cavity, follows the law of head-presentations. The occiput comes round to the pubic arch, then the chin and face sweep the pelvic floor, flexion being restored.

Closely following, almost accompanying the breech, come the feet and legs. When the whole pelvic extremity is born, if the process is left to nature, the arms appear placed upon the chest, the elbows preceding the shoulders.

In the second abdomino-anterior breech-position, R.A.A.P. (see table, p. 156) which springs from the second cranial, the bi-trochanteric diameter lies in the right oblique diameter of the pelvis, the right ischium being in relation with the right sacro-iliac joint. The breech descends in like manner, obliquely; the nearest or lowest ischium, the left, gets under the pubic arch, and emerges first; whilst the hinder one, taking a larger curve, sweeps over the perinæum. The feet and knees appear flexed, then the trunk, then the flexed arms, then the shoulders, which have passed through the same oblique diameter—the right, as the breech—are delivered. The head, which has passed through the opposite or left oblique diameter,

comes down; the occiput comes under the pubic arch, a little obliquely, and the chin and face sweep the perinæum.

The two dorso-anterior positions are the most favourable, and the most frequent. They spring out of the third and fourth cranial positions. There is no inconsistency in this statement. According to Naegele, the third position, occipito-posterior, is much more frequent than is the second position, occipito-anterior. It may well be, then, that the third position, which is so remarkably disposed to change, may more frequently than the other presentations result in breech-presentation.

The third breech, or L. D. A. P. (see table, p. 156), has its bi-trochanterie diameter in the left oblique diameter, its left ischium anterior and lowest. Deseending thus into the pelvic cavity, the left ischium rotates a little forwards, gets under the right ramus of the pubic areh; the opposite ischium sweeps the perinæum, the back of the fœtus looks obliquely forwards; the feet and knees emerge nearly with the breech, the trunk follows in the same direction, arms and chest are delivered; the shoulders, which have passed through the left oblique diameter, then pass the vulva, preserving something of the original obliquity, but approaching the conjugate diameter of the outlet, so that the abdomen, when born, looks towards the mother's right thigh or buttoek; the head then, having passed through the brim in the right oblique diameter, engages with its occiput under the pubic arch, with its long diameter approaching the conjugate diameter of the pelvic outlet; the ehin and face then sweep the perinæum.

The fourth, or R. D. A. P., springs from the fourth cranial. It follows a similar course to the other dorso-anterior position, simply substituting left for right.

The mechanism of breech-labour may be summed up in six steps:—

- 1. Balling or moulding of the breech.
- 2. Engagement and descent of breech; lateral or sigmoid flexion of the trunk.
 - 3. Rotation of breech and trunk.
 - 4. Disengagement of breech.
 - 5. Interior rotation of head.
 - 6. Expulsion of head.

Naegele and Collins stated it as a law in nates-presentations, vol. 11.

that, whatever may be the direction of the child in the abdomino-posterior positions at the beginning of labour, it will always, if not interfered with, be found with its anterior surface turned towards one or other sacro-iliac joint, when the thorax or the shoulders are beginning to pass through the outlet of the pelvis. When the nates have once passed the vulva, the position of the child frequently varies a good deal, the abdomen turning first to one side and then to the other. This is especially the case in the second, or R. A. A. P., where it is more or less forwards; nevertheless, as labour advances, it will almost invariably turn obliquely backwards, and be born in this position.

The Management of Ordinary Breech-labour.

Having traced the mechanism of labour in the several breech-positions, we may follow the clinical history. In a considerable proportion of breech-presentations, the labour sets in prematurely, without much warning. If we have the opportunity of examining before the membranes have burst, we may find the lower segment of the uterus resting on the pelvic brim, but not much dipping into it. Instead of the firm globular expanse of the head we find something different, a more conical presenting part, less firm, not so accurately blocking the os internum; the shape of the bag of membranes is more pointed. Not finding the head in its expected place, we seek for it by palpation of the abdomen, where it may generally be felt at the fundus of the uterus; auscultation will point to the situation of the heart, at a higher level than is usual in headpresentations (see figs. 31, 32). Returning then to vaginal examination, we feel for the characteristic features of the breech. These are: the ischial tuberosities, rounded bumps, one of which, the anterior, is lower in the pelvis than the other; between the tuberosities we feel a soft depression or groove; at one end of this groove we touch the genital organs. In the male, the testicles, scrotum, and penis are not difficult to distinguish; in either sex, carrying the finger backward, we feel the anus, coccyx, and the ridged lower end of the sacrum. This last mark is very characteristic. It further tells us whether the position is dorso-anterior or dorso-posterior.

The rupture of the membranes takes place in a manner

somewhat different from that observed in head-presentations. In these last, the inferior segment of the uterus forms a pouch, accurately filled by the head. Thus, when the bag bursts, there is a sudden gush of water, then the flow is stopped by the head driven down like a ball-valve. In breech cases, the gush is not so sudden; the waters continue to flow until the uterus is nearly emptied.

When the membranes have ruptured, as is not seldom the case, early in labour, before the cervix is far expanded, the preceding marks are more easily made out. But care should be taken not to examine too frequently or roughly, lest the child's genitals be bruised. At this time the equivalent of the caput succedaneum, in the shape of tumefaction, is formed upon the presenting part, which is gripped by the cervix uteri. This tells especially upon the scrotum, the loose tissue of which readily becomes infiltrated. Thus the characters of the parts may be obscured.

At this stage, meconium may escape with the discharges. This is almost conclusive evidence of breech-presentation. The voiding of meconium is held to be a respiratory act. It implies some difficulty in the equivalent of air-respiration, namely, in the utero-placental circulation. This may arise from compression of the umbilical cord, or from compression of the placenta upon the child's head by the contracting uterus. This denial of oxygenated blood compels the fœtus to seek for air. The effort, consequent upon this besoin de respirer, induces reflex movements, which result in the evacuation of the urine and meconium. Meconium then appearing in the discharges, gives warning that the child is in danger, and is an indication to accelerate the delivery. This warning is often accentuated by another cognate phenomenon: twitching of the child's legs—a reflex movement. We must not, however, allow ourselves to be hurried into precipitate action. The child will not be rescued by such action. We have repeatedly seen children born alive several minutes, fifteen and more, after the appearance of meconium.

Meconium is also often voided by a purely mechanical process of squeezing. This takes place when the child's abdomen is being tightly grasped by the vagina and vulva. Meconium is then seen to be squeezed out, the nates being outside the vulva.

One rule, before resorting to accelerative measures involving traction, should be rigidly observed. It is to secure, in the first place, adequate dilatation of the cervix uteri, so that the chest and head may pass easily. If extraction be made before this facility is attained, the child will probably be lost, and the mother may suffer contusion and laceration. If then the membranes point too conically, so that the presenting part cannot enter to dilate the cervix, or if, after rupture of the membranes, the cervix remains unexpanded, dilate by means of Barnes's bags. These will accomplish the end without violence.

When the labour is premature, it often progresses rapidly from this point; the uterine action and respondent respiratory abdominal action assume a stormy character, and the child may be expelled so rapidly that little or no time is allowed for observation or assistance. In such eases the child is likely to be born living. This stormy action of the uterus, Tyler Smith explains as the result of the quick and complete escape of the liquor amnii. The inner surface of the uterus is thus brought into multiplied points of contact with the body of the fœtus; and the diastaltic function is excited in proportion.

In other cases, mainly of full-sized children, the labour in the first stage is tedious. The breech is not so well adapted as the head to expand the cervix uteri. The passage through the pelvis may not exceed the time observed in head-labours. If any undue delay occur when the breech is engaged in the outlet, the wedge formed by the breech and legs may be decomposed by gently drawing down one foot—the one nearest the perinæum is the best—and bringing it outside. This sensibly diminishes the bulk that has to pass; if, then, at the same time that we exercise gentle traction upon this leg, wrapped in a diaper, in the direction of the axis of the brim, we get an assistant to exercise steady pressure upon the fundus uteri downwards, the progress of the labour is much facilitated, and without injurious interference.

Another manœuvre may sometimes be practised when the breech hangs at the outlet. The index finger may be insinuated into the posterior groin of the fœtus, and gentle traction made in the direction of Carus's curve. We say this may sometimes be done; but we believe the practice is unscientific. It does not fulfil the great condition of decomposing the wedge

formed by the breech and thighs; and should the legs be extended—and we cannot know without passing the hand into the pelvis if this is the case or not—the difficulty is increased by pulling the wedge tighter into the pelvis. When describing the operation of turning, we shall show how to overcome this difficulty by bringing down a foot.

We must scrupulously abstain from more interference than

We must scrupulously abstain from more interference than this if possible, for, the breech delivered, two complications easily provoked by injudicious meddling are at hand: the first is derangement of the orderly mechanism of the labour, that is, disturbance of the due relation between the parts of the child and that zone of the pelvic cavity which it is occupying. This is the evil that is produced by what is called 'giving the turns.' Some over-diligent obstetrists not realising the great law of adaptation, yet knowing that the child commonly rotates back forwards, think they are helping Nature by putting a rotating force upon the limb unfortunately in their hold, and by its means trying to twist the body round—a vicious practice condemned by sound theory and experience. We have in the 'Obstetric operations' dwelt with necessary emphasis upon the rule that all traction must be simple traction in the axis of the pelvis, giving progression only, and leaving to Nature to accomplish the rotations in her own way, as she will infallibly do under her law of accommodation, if not thwarted by superfluous help. This rule applies to the forceps as well as to extraction by the pelvic extremity.

At this time, the cord comes within danger of compression. When the umbilicus is below the pelvic brim, it is liable to be jammed between the child's body and the side of the pelvis, and thus, its circulation being obstructed, the child may die of asphyxia. How is this danger to be averted? If we find the cord well pulsating we may give time for the full dilatation of the passage above, so as to permit of the rapid passage of the head. It is obvious that the risk of injurious pressure is even greater from the head, which is harder, larger, and more apt to be delayed. Two things may be done: 1. Draw down gently a small loop of cord, so as to take off tension upon the umbilicus; 2. If you can, push the cord over to one side of the promontory, where it will be to some extent protected in the hollow from pressure.

Now watch the cord; so long as it pulsates well, and the labour advances, wait. If on the other hand the pulsation flag or cease, and the labour is suspended, we are justified in accelerating delivery. There are two chief ways of doing this: 1st, by traction on the legs and trunk aided by pushing-force above; 2nd, by forceps, equally aided by pushing. In some cases traction may offer the quickest relief. The operation will be described under the head of 'Turning.' In other cases, the forceps is the quickest. It is generally the safest, the surest, and should, in our opinion, be preferred. This operation, the application of the forceps to the after-coming head, will also be described in another place.

The arms may rnn up by the side of the head. If the labour march by itself, the arms will usually pass flexed upon the chest. But if the labour be in any way hnrried, and especially if attempts be made to give the turns, one or other arm hitching npon the brim of the pelvis will be delayed, whilst the head is carried down. The arm or arms thus applied to the side of the head form a wedge too large to pass through the pelvis. Hence the arrest of labour, and increased danger to the child from compression of the cord. The indication, again, is clear to decompose the wedge. This is done by passing the hand into the pelvis, carrying the index np along the child's back so as to reach the scapula and shoulder, then slipping the finger over the acromion and down the humerus; this is thrown in flexion across the child's chest, restoring the natural relations. When this is done, the head is free, and can advance either under natural propulsion, under gentle traction, or by aid of forceps. This operation we have described as the liberation of the arms.

This operation will be described in detail and illustrated in the chapters on Turning, and Dystocia from certain difficult breech-labours.

When the arms and chest have passed, the chin may hitch upon the brim; then, extension being produced, the proper mechanism of the labour is disordered. It is another consequence of prematurely pulling upon the legs or 'giving the turns.' The method of dealing with this will be described when relating the history of dystocia in head-last labours.

During the passage of the chest and head the trunk should

be supported; and it is well to wrap it in a warm diaper. Carc should be taken in handling the child during the labour to interpose a soft cloth between the fingers and its limbs.

The child is in danger from four causes: 1. From compression of the cord between its ehest or head and the pelvic wall; 2. From delay in labour from arms running up by the sides of the head; 3. From compression of the placenta between the child's head and the contracting uterus; 4. From constriction of the child's neek by the lower section of the uterus.

In all these cases, compression of the eord is an almost necessary complication; 2 and 4 are especially due to untimely and vicious interference. Pulling upon the child disturbs the harmony of relation between the child and the passages, and throws the action of the uterus into disorder, inducing perhaps a tetanoid condition, or excessive spasmodic action of the lower segment, and so strangling the child.

We do not here dwell upon other dangers to the child resulting from injudicious practice, as these will be pointed out in the chapter on Turning.

The statistics of mortality, whether of mothers or children, usually stated, are vitiated by several fallacies. A leading one is that they are compiled from tables made up of the most discordant cases, which defy analysis and right appreciation. Thus the tables deduce included cases in which not Nature, but Art, was responsible for the death. We cannot justly count, as an item showing the risk to the life of the child, a death which was caused by dragging the child forth, 'giving the turns,' setting up tetanoid action of the uterus, or other forms of malpraxis. If we could ascertain the proportion of children born dead under ordinary conditions without undue interference, we might arrive at the true mortality. This would certainly considerably exceed the proportion of still-births in ordinary head-first labours; but it would probably fall far short of the mortality resulting from the inclusion of cases treated nimiâ diligentiâ.

The risk to the mother in brecch-labours in ordinary cases is not great, probably not much exceeding that of head-first labours. Inasmuch as the labour is more protracted, this factor must be reckoned upon as a danger in puerpery.

The risk of laceration is hardly greater than in head-first labours. Rupture or laceration of the uterus or vagina are more

often due to the operator's manœuvres than to spontaneous action. The perinæum is more likely to rend under the passage of the head.

The head in breech-labours commonly escapes with little deformation. The passages have been well dilated by the breech and trunk, and thus the head undergoes comparatively little compression. It preserves, in fact, very nearly its primitive spherical shape. Spiegelberg advances that the spherical shape is due to the pressure exerted by the genital canal upon the circumference of the head, whilst the absence of pressure from above leads to increased bulging of the convexity of the cranium. The theory is ingenious; but we are convinced, from close observation of the course of these labours, and measurements of heads taken after every variety of labour, that the explanation we have given is correct and sufficient. The head, escaping undue pressure, simply preserves its natural sphericity.

The equivalent of the caput succedaneum presents itself upon the presenting breech. The main swelling is formed upon that part which was lowest in the pelvis, and therefore upon the anterior buttock, extending to and involving the genitals. The scrotum is often remarkably swollen, ædematous, even ecchymosed, of a dark livid colour, greatly disfigured. This appearance is apt to give rise to the suspicion of mismanagement of the labour, if not of culpable injury, by the obstetrist. Suspicion of this kind rouses a strange feeling of resentment in the minds of the female attendants. It is wise, therefore, to warn them beforehand of what may be expected as the usual consequence of breech-labours, and fears of future mischief may be allayed by the confident assurance that all this shocking appearance will disappear in a few days. No special treatment is required.

Knee and footling-presentations are simply modifications of the breech-presentations. We have only to imagine that, in an original breech-presentation, the legs drop away from the trunk, and we get the knees or feet presenting. The positions of these presentations are the same as those of the breech. There are two dorso-anterior and two abdomino-anterior. They are especially apt to occur when the child is dead or premature.

The diagnosis is only certain when we feel the parts. But there is a peculiar condition of the bag of membranes. This points more conically; it does not so easily dilate the cervix; the presenting part is higher, more difficult to reach. But when the liquor amnii escapes, and even before, we may commonly feel a knee or foot. We should not be content with merely detecting a foot; we should proceed to determine how it lies. The heel corresponds to the child's back; the toes to its abdomen. Thus we may tell whether the position is a dorsal or an abdominal anterior.

The Mechanism and Natural History of Labour in Oblique or so-called Transverse-Presentations.

The history of presentations, entitled under the various terms of oblique, transverse, cross, shoulder, arm, trunk, is full of physiological and clinical interest. The key to the right understanding of this history lies in the careful observation of Nature. We must enter upon the study with candid minds, free from all prejudgments, accepting in the first place the facts as Nature presents them as the foundation of theory, and then upon these facts constructing such theories as the facts will sustain. We shall by this method arrive at fairly definite therapeutical indications, showing us how far we may safely trust to Nature, and when and how Art may be best invoked. This principle applies, indeed, to all the great problems in medicine; but it does so with especial force to this one, which has been so much obscured and complicated by practices that have prevented Nature from demonstrating her resources and her power. Contrary to the order followed by most writers, we give a place to the transverse-presentations in the section devoted to the mechanism of ordinary labour. These presentations stand in such physiological connection with the more strictly normal presentations, that they are more likely to be correctly understood in their pathological bearings if studied in this connection. Another reason for this arrangement is that transverse-presentations are not necessarily causes of dystoeia. Some cases, perhaps more frequent than is commonly believed, terminate by the natural powers. The cases which require the intervention of art will be studied under the heads of 'Dystocia' and 'Turning,' and other operations.

The Causes of Transverse-Presentations. The factors which act in the production of vicious presentations, and the modes in which they act, logically demand the first attention. In discussing the origin of breech presentations we have pointed out that, in the latter months of gestation, the fœtus may easily, under conditions inherent in the woman or fœtus, or accidental influences from without, change its position.

- 1. The fundamental question is: What are the factors which determine the ordinary position of the factus in utero? This question has been answered in preceding chapters, if not completely, at any rate with some degree of fulness.
- 2. The next question will be: What are the conditions which produce the frequent changes from the ordinary position?
- 3. A third question is: What are the powers of Nature, or rather the methods employed by Nature, in dealing with unfavourable positions of the fætus?

It is convenient to begin by describing the several varieties of malposition of the fœtus which are observed.

As in the cases of head and breech-presentations, so in transverse-presentations there are two principal orders:—

- A. Dorso-anterior. { 1. Right arm to left. 2. Left arm to right.
- B. Abdomino-anterior. { 1. Right arm to right. }2. Left arm to left.

Reference to Table p. 156 will show the evolutional relation of the several shoulder or transverse positions to those of the head out of which they are assumed to arise. The two dorso-anterior positions arise out of the two occipito-anterior positions. This will be understood by observing what takes place when deflecting the head from the brim towards the iliac fossa, the first stage in the production of breech-presentation. When the head is thus fairly lodged in the iliac fossa, the shoulder comes over the brim; the presentation is now oblique, or of the shoulder; the dorsum looking forward. Conversely, the two abdomino-anterior positions arise out of the two occipito-posterior positions.

For practical purposes it may be enough to recognise the grand distinction between dorso-anterior and abdomino-anterior positions, without considering further differentiations; but to

obtain a fair physiological idea of the matter, it is necessary to describe the varieties. We describe, then, the two dorso-anterior positions (see Table, p. 156):—

- 1. In the one, L.D.A.P., the head being deflected into the left iliac fossa, the right shoulder comes over the brim, whilst the breech occupies the right side of the body of the uterus, rising out of the iliac fossa, the dorsum looking forwards.
- 2. In the other, R.D.A.P., the head is deflected into the right iliac fossa, the left shoulder comes over the brim, whilst the breech occupies the left side of the body of the uterus, rising out of the iliac fossa, the dorsum looking forwards.

The two abdomino-anterior positions:—

- 3. In the R.A.A.P. the head is deflected to the right iliac fossa; the right shoulder comes over the brim; the breech occupies the left iliac fossa; the abdomen looks forwards.
- 4. In the L.A.A.P. the head passes into the left iliac fossa; the left shoulder comes over the brim; the breech occupies the right iliac fossa.

In most cases, early in labour, it will be found on examination that the position is more oblique than transverse. It becomes more transverse as labour advances and the shoulder or arm is driven into the pelvis. True transverse-positions are necessarily rare. The long axis of the child bends at the neck—that is, much nearer to one end; thus, the head bends upon the shoulders and finds accommodation in an iliac fossa, whilst the trunk and breech, forming the longest part, must find accommodation at a higher level in the fundus of the uterus. The position is therefore oblique.

We may now return to our second question: What are the conditions which produce the frequent changes from the

ordinary position?

Any considerable disturbance in the equilibrium of the factors which keep the fœtus iu its due position, of course, favours malposition. The following are the principal disturbing conditions:—Excess of liquor amnii. This acts in two ways:

(a) it favours increased mobility of the fœtus; (b) it tends to destroy the elliptical and flattened form of the uterus. The middle zone of the uterus increasing in greater proportion than the long diameter, the cavity becomes more spherical. Heuce the fœtus is no longer kept in perpendicular relation to the

brim of the pelvis, for want of the proper relations between its form and size and those of the uterus. It easily revolves when any moderate force is applied; and if at such a moment the membranes burst, the fœtus may be fixed in its unfavourable position by the contracting uterus. 2. Obliquity of the uterus was held by Deventer to be a main cause of malposition. Latterly it has been somewhat discredited; but we believe it to be a very effective factor. Wigand, Dubois, and Pajot demonstrated that deviation of the uterus to the right greatly preponderates over every other position. Referring to the description given of Naegele's obliquity of the feetal head, and its relation to obliquity of the axis of the uterus in relation to the axis of the pelvic brim, we shall see how the more decided and vicious obliquities of the fœtus arc consequences of the same laws operating under exaggerated conditions. As the uterus grows during pregnancy, rising above the pelvic brim, the projecting sacro-vertebral angle and the curve of the lumbar column deflect its fundus to one or other side; and if the abdominal walls be very thin and flaccid, as happens in some multiparæ, the fundus uteri will fall forwards. The tendency of these obliquities, if carried beyond ordinary measure, is to throw the axis of the uterus further ont of the axis of the brim, and to bring some other part than the vertex of the fœtus to present. The probability of this will be increased by the irregular contractious of the uterus, apt to be excited by parts of the fœtus pressing uuequally upou its walls. For example, in extreme lateral obliquity, the breech may press strongly upon oue side of the fuudus; contraction taking place here will drive the head further off the brim ou to the edge, where, if it find a point d'appui, it will rotate ou its transverse axis, producing forehead or face-presentation, and, as a further stage, favouring the desceut of the shoulder. Wigand pointed out how a too loose and shifting relation of the uterus to the pelvis disposes to cross-birth. this condition it is observed that the head is placed uow in one spot, now in another, and theu not felt at all. Wigand 1 further says that any obliquity of the uterus exceeding an angle of 25° is unfavourable; and that even a lesser obliquity, with excess of liquor amnii or a small child, is likely to cause the presenting head to be displaced and to bring a shoulder iuto the brim,

¹ Die Geburt des Menschen, 1820, vol. ii. p. 137.

especially if strong pains or bearing-down efforts be made early in labour. Illustrating and enforcing this theory, he showed that the os uteri might be brought down over the centre of the brim by internal pulling upon the os, combined with external pressure upon the fundus in the opposite direction, thus putting in practice the principle of bi-polar turning by acting simultaneously upon the two poles of the uterus.

The attachment of the placenta to the lower segment of the uterus is, as Levret has clearly shown, a cause of malposition by forming an inclined plane, which tends to throw the fœtal head out of the pelvic axis across the brim. Hence the frequency of cross-birth and of funis presentation in cases of partial placenta prævia. But, as we have shown, there are numcrous cases in which the placenta dips into the lower zone, growing downwards from the posterior and lateral walls of the uterus, without leading to hæmorrhage, and thus not suspected to be cases of placenta prævia, which, nevertheless, form an inclined plane behind or on one side, and thus produce malposition.

Want of tone in the uterus, which implies inability to pre-

Want of tone in the uterus, which implies inability to preserve its elliptical form, and a tendency to fall into rotundity, a form which especially favours malposition. Scanzoni says laxity of the uterus is a chief cause. As soon as contraction begins the uterus tends to resume its ovoid form.

Irregular or partial contractions of the uterus cause malposition. Naegele insisted upon this. He found that in some cases malposition was averted by allaying spasm. Heyerdahl says contractions of the uterus are a chief factor, and these are often caused by palpations. This no doubt accounts for a large proportion of the changes of position encountered by the too industrious German observers. They produce the changes they observe.

Credé, Hecker, Valenta, Gassner, Heyerdahl, Schultze found ehange of position even more frequent than other observers. Valenta¹ examined 363 multiparæ and 325 primiparæ in the latter months of pregnancy. He found that a change of position took place in 42 per cent. Change was more frequent in multiparæ, and in these in proportion to the number of pregnancies. Circumvolutions of the cord, so often observed, are produced by changes of position, and so bear

¹ Monatsschr. für Geburtskunde, 1866.

evidence to the correctness of the proposition. On the other hand, shortness of the cord, or entanglement of the cord round a limb, may, by giving a short tether, lead to malposition.

The shape of the uterus may dispose to malposition. Thus, excessive width of the body and fundus may favour transverse or oblique position of the child. Bocker showed that in many cases at least of excessive breadth of the uterus, the essential condition was the persistence of a minor degree of the primitive bicornute state. In this condition the fundus is comparatively depressed, whilst either horn bulging out expands it in width. In this way the long axis of the uterus is relatively shortened.

The development of the fætus in the latter months may, as Hoening pointed out (Scanzoni's Beiträge, 1870), be an important factor. A large fætus cannot so easily change position. The cranial-presentation has the greatest stability. A fourth cranial changes to a first, and a third to a second; but the cranial rarely changes to a breech. Cranial and breech-presentations are most stable in primiparæ; oblique-presentations in pluriparæ.

Premature and dead children are especially prone to present transversely. We have seen that a principal factor in maintaining or regaining erect position depends upon the resiliency of the child's body, a vital property. After its death this resiliency is soon lost. Then the body is easily compressed, loses its ovoid shape, and, yielding to the concentric pressure of the uterus, becomes doubled up or 'balled.' This happens mainly after the escape of the liquor amnii, and is a frequent sequence upon oblique-presentations occurring during the child's life.

Monsters also are especially prone to malposition. Wanting in some natural property of shape, size, or resiliency, they easily assume irregular positions.

Deformity of the pelvis or lumbar vertebræ is often a powerful factor. The comparative frequency of transverse-presentations in cases of deformed pelvis is certainly greater than where the pelvis is well formed. If we may trust our own experience, however, we should say that slight deformity has more influence in causing malposition than extreme deformity. In the latter case, malpositions are rarely observed. In marked deformity

¹ Die Bicornitöt des Uterus als Ursache der Querlagen, 1875.

the head cannot euter the brim, but floats free above it, encountering equal obstruction at every point, and is therefore not affected by hitching on the edge at one point.

The influence of external forces may, with or without the concurrence of the conditions above described, be a determining cause of malposition. This is felt in the action of pressure applied to the uterus through the abdomiual walls. The dress of a woman at the end of pregnancy is a matter of no small moment. The pressure of a rigid busk of wood or steel upon the fundus of the uterus, modified by the various movements of the body, may flatten in the fundus, thus reducing the longitudinal diameter of the uterus; or it will push the uterus further to one side, causing or increasing obliquity. It will at the same time press directly upon the breech, and thus tend to give the fœtus an oblique position, throwing the head out of the pelvic brim. Pluriparæ should dress on the very opposite principle. They should discard the busk and wear an abdominal belt which supports the fundus of the uterus from below upwards.

A condition, to which adequate attention has not, we think, been drawn, is the pouch-like disposition of the lower segment of the uterus as a preservative against malposition. In primiparæ, the head is lodged in this pouch in such a manner that, even without the support of the pelvic brim, it cannot well rise out of it. This disposition is impaired in multiparæ, and hence their increased liability to malposition.

It is interesting to observe that the general teudency of changes of position is towards those which are most propitious. Thus, cranial positions are least liable to change, whereas oblique positions are specially liable to change. These mostly pass into the long axis by spoutaneous versiou. This is but another expression of the continuing influence of the law of accommodation between uterus and feetus, or of the operation of those factors which determine the ordinary position of the feetus.

Self-version is a very frequent resort of Nature. In some cases several changes of position have been observed in the same patient. P. Müller relates a case in which within five days a complete version was effected six times. Esterlè gives abundant evidence to the same effect.

^{1 &#}x27;Sul rivolgimento,' Annali Univ. di Medicina, 1859.

The Powers of Nature in Dealing with Unfavourable Positions of the Fætus.

It is useful here to call to mind those minor deviations from the typical normal position in which the long axis of the child's body still maintains approximate coincidence with the axis of the pelvic brim. With some additional difficulty, Nature is in most of these cases able to effect delivery without materially modifying the position. Forehead- and face-positions have been described, and the modes in which Nature deals with them. Difficult breech-positions will be especially considered hereafter.

From the time of Hippocrates downwards, who compared the child in utero to an olive in a narrow-mouthed bottle, it has been known that the child could hardly be born if its long axis lay across the pelvis. But before the time of Denman, it was not clearly understood that a correction of the position, or a restitution of the child's long axis to adequate coincidence with the axis of the pelvic brim, could be brought about by the spontaneous operations of Nature. And observations of this interesting natural phenomenon are so rare that there are men, even at the present day, who fail to realise the accuracy of Denman's description. This description contains the pith of the whole question. It is right to quote it:—'In some cases the shoulder is so far advanced into the polvis, and the action of the uterus is at the same time so strong, that it is impossible to raise or move the child. . . . This impossibility of moving the child had, to the apprehension of writers and practitioners, left the woman without any hope of relief. But in a case of this kind which occurred to me about twenty years ago, I was so fortunate as to observe that it was not in my power to pass my hand into the uterus . . . that, by the mere effect of the action of the uterus, an evolution took place, and the child was expelled by the breech. . . . The cases in which this has happened are now become so numerous, and supported, not only by many examples in my own practice, but established by such unexceptionable authority in the practice of others, that there is no longer any room to doubt of the probability of its happening more than there is of the most acknowledged fact in inidwifery. As to the manner in which

this evolution takes place, I presume that, after the long-continued action of the uterus, the body of the child is brought into such a compacted state as to receive the full force of every returning pain. The body, in its doubled state, being too large to pass through the pelvis, and the uterus pressing upon its inferior extremities, which are the only parts capable of being moved, they are gradually forced lower, making room as they are pressed down for the reception of some other part into the cavity of the uterus which they have evacuated, till the body turning as it were upon its own axis, the breech of the child is expelled, as in an original presentation of that part. I believe that a child of the common size, living or but lately dead, in such a state as to possess some degree of resilition, is the best calculated for expulsion in this manner. Premature or very small children have often been expelled in doubled state, whatever might be the original presentation; but this is a different case from that we are now describing.'

In this passage Denman plainly sketched out the two principal methods by which Nature deals with transverse-presentations of the fœtus. These are now known (1) as spontaneous version, or rectification of the presentation; (2) spontaneous evolution, or expulsion of the fœtus by 'balling' or doubling-up of the fœtus.

Let us study these two natural processes more closely, since in them we find the key to rational methods of treatment when Nature fails in her intent.

The first process is called 'versio spontanea,' 'version spontanée,' 'Selbstwendung.' On the other hand, the term 'spontaneous evolution' or 'expulsion' is rightly applied to that process by which the ehild is driven through the pelvis doubled up, the presenting shoulder or arm retaining its position all through.

The only mistake Denman made was in using the term 'evolution' instead of 'version.'

1. Spontaneous Version or Rectification.

Labour with shoulder-presentation must obey the same laws as labour with head-presentation. The difference lies in the altered relation or equilibrium of the ordinary factors of labour. The factors remain.

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Shoulder-presentations may be *primitive* or *secondary*. The *primitive* exist before labour has set in, and are almost necessarily associated with obliquity of the uterus. The

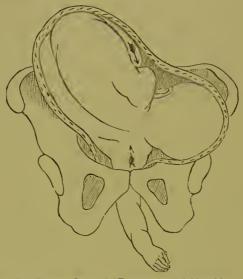


Fig. 34.—Showing Second Stage in Production of Shoulder-prescutation.

secondary are produced during the initiatory stage of labour, under conditions which lead to the deflection of the head from

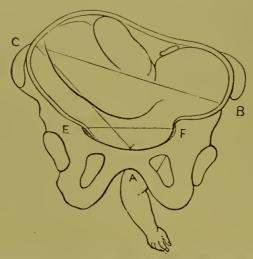


Fig. 35.—Showing further Stage in Production of Shoulder-presentation.

A. Apex; B.C. Base; E.F. Transverse diameter of pelvic brim.

the pelvic brim when it is made to move under the influence of force applied to the breech or trunk.

Spontaneous version must be distinguished from spon-

taneous evolution or expulsion. 'Version' is the proper term to express the restoration of a normal position favourable to delivery—that is, a position in which the long axis of the child is brought into coincidence, or nearly so, with the axis of the uterus and with the axis of the pelvis. Thus the relative position of the child is changed.

There are two varieties of spontaneous version, one in which the head is substituted for the shoulder, the other in which the breech is substituted for the shoulder. These varieties of spontaneous version are the key to two corresponding varieties of artificial version.

These processes may now be described.

In fig. 34 is a diagrammatic scheme representing the second stage in the production of a shoulder-presentation out of one of the head.

Fig. 35 represents the next stage in the production of shoulder-presentation: the breech is further depressed; the axis of child and uterus presents a further divergence from the axis of the pelvis; the head has lodged in the left iliac fossa.

Version by the Head, or Cephalic Version.

In the first stage, the long axis of the child and of the uterus stands obliquely with reference to the pelvic axis. At the beginning it is not very distant from the perpendicular of the brim. It is a serious error to regard these presentations as absolutely cross or transverse. It is only in the advanced stage of labour with shoulder-presentation, when the liquor amnii has been long drained off, when the uterus has been contracting forcibly, driving the shoulder deeply into the pelvis, that the child can truly be said to lie across the pelvis. Diagrams copied from text-book into text-book have tended to fix this false idea in the obstetric mind. Yet the great masters bear distinct evidence to the contrary. Wigand insists that trańsverse positions are rare. Esterlè and Lazzati say the same, and maintain that the oblique position is favourable to spontaneous version. We venture to say that, except in cases of dead, monstrous, or small children, or with loss of force of the uterus through excess of liquor amnii, a true cross-birth, such as is commonly pictured and generally imagined, does not

exist at the commencement of labour. It would be better to discard the terms 'cross-birth' and 'transverse-presentation' altogether, and to speak of shoulder or oblique-presentations only. In the shoulder-presentation an oblique position of the child may become transverse in the course of labour; but the presentation is not transverse *ab initio*. The failure to realise this fact has been a main cause of the errors that prevail in the doctrine and practice of Turning.

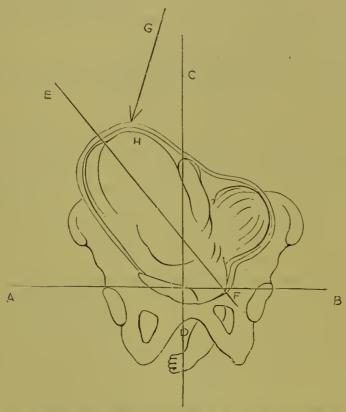


Fig. 36.—Shewing acute flexion of Head upon Trunk, or 'balling.'

In diagram (fig. 36) the child and the uterus EF stand obliquely, at an angle of about 15° or 20°, to a perpendicular CD, drawn upon the plane AB of the pelvic brim. The child's head is nearly in a straight line with its spine. It stands partly over the brim, and partly projecting beyond into the left iliac-fossa. This is the *first act*. This act may pass back into natural head-labour. Wigand, Jörg, and d'Outrepont say this position is common, and that the effect of the first uterine contractions

is usually to bring the long axis of the uterus and of the child into due relation with the pelvic brim. This phenomenon is, in fact, a form of self-turning or natural rectification.

Version by the breech.—If this attempt at rectification fail, then we have the transition into shoulder-presentation. shoulder or arm cannot come down into the pelvis until the second act, a movement of flexion of the head upon the trunk, takes place. This happens in the following manner:-The muscles of the fundus uteri contracting, aided or not by the downward pressure of the abdominal muscles and diaphragm, bring a force acting primarily upon the breech, which lies at the fundus. This force will strike with greatest effect upon the left or uppermost side of the breech, at an angle with the long axis of uterus and child. The line GH represents the direction of this force. The result is that the breech descends. If the cavity of the uterus were as broad as long—that is, if it were a flattened sphere or short cylinder—the child's long axis, formed by spine and head, might preserve its rectilinear character; and as the breech descended, the head would simply rise on the opposite side until it came round to the spot abandoned by the breech, performing, in fact, complete version. But the uterus is narrower from side to side than from top to bottom. The head will find great difficulty in rising; it therefore bends upon the neck. The shoulder pertaining to the trunk is kept at the lowest point in a line with it. The head is thrown more into the iliac fossa, where it rests for a while. Fig. 36 represents this second position of the child. AB is the plane of the brim; CD the perpendicular to the plane, representing the axis of entry to the pelvis; EF is the axis of the child's trunk; and GH shows the direction of the downward force, which now strikes the uterus and child at a greater angle with the perpendicular.

Now the arm will commonly be driven down, and the hand may appear externally. The observation of the hand will tell the position of the child. The back of the hand looks forwards, the palm looks backwards, the thumb to the left. All this tells plainly that the head is in the left iliac fossa, where, indeed, it may be discovered by palpation, and that the child's back is turned forwards to the mother's abdomen. The right scapula will be close behind the symphysis pubis; the acromion and

right side of the neek will rest upon the left edge of the pelvic brim; and the right axilla and right side of the chest will rest upon the right edge of the pelvic brim; whilst the belly and legs of the child, turned towards the mother's spine, will occupy the posterior part of the uterus.

At this stage, even after the liquor amnii has been partly drained off, spontaneous version may still be effected. The process described as the second act still continuing, the breech is driven lower, the trunk bends upon its side, the curve thus assumed by the long axis carries on the propelling force across

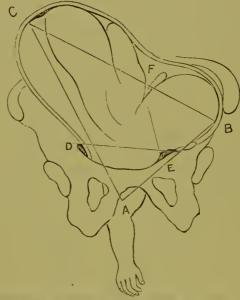


Fig. 37.—Shewing Arm-presentation. Head flexed on Trunk. (R. B.) $_{\rm E}$ F. The line which bisects the wedge ABC.

the pelvic brim, the head tends to rise still higher in the left iliac fossa, the presenting shoulder and prolapsed arm are drawn upwards a little out of the pelvis. This *third act*, one marked by increased lateral flexion of the child's body, and of movement across the pelvic brim, is represented in fig. 37.

If spontaneous version is to be completed, the fourth act succeeds. The breech, being the most movable part, receiving the main impact of the driving force, and the trunk being capable of bending upon itself, partly on its side, partly on its abdomen, is driven lower and lower; the right shoulder being forced well over to the left side of the brim, and the head being fairly lodged in the upper part of the iliae fossa, the

brim is comparatively free for the reception of the trunk. This enters in the following manner:—The right hip comes first into the brim; it is forced lower and is followed by the breech. As soon as the breech enters the pelvis—that is, as soon as it gets below the sacral promontory—a movement of rotation takes place, analogous to the rotation which the head takes in head-labour. There is most room in the sacral hollow, and there the breech will turn, following Barnes's curve. This turn of the trunk brings the body from the transverse position it occupied above the brim to one approaching the antero-posterior, and commonly the head yields somewhat to the altered direction of the spine by coming more forward.

When this rotation movement is effected, or rather simultaneously with it, a movement of descent or progress in an arc of a eircle round the pubic centre goes on. The flexion of the spine is now reversed. Above the brim the trunk was coneave on its left side, as seen in figs. 34, 35, 36. When the breech has dipped into the pelvis, the trunk becomes concave on its right side. The breech descends first. The right ischium presents at the vulva. Then the whole breech sweeps the sacral concavity and perinæum. The trunk follows. The right arm, which has not always risen completely out of the way, comes next; the left arm, and lastly the head, the right side of the occiput under the pubic arch taking its rotation movement and its movement in Carus's eurve.

Spontaneous Expulsion or Evolution.

Let us now contrast spontaneous version with spontaneous evolution—'evolutio spontanea,' 'Selbtsentwickelung,' 'évolution spontanée.' The cause of the difficulty that opposes delivery in shoulder-presentation must be first understood. The pelvic canal is too small to permit a full-sized living child to pass freely when its long axis lies across the inlet. On looking at fig. 37 we see the shoulder driven into the pelvis, forming the apex A of a triangle or wedge, whose base B C is considerably longer than any diameter of the pelvic brim. To overcome this difficulty, Nature struggles to shorten the base B C. To a certain extent she generally succeeds, and oceasionally she succeeds completely.

When the liquor amnii has escaped, the nterus contracts concentrically, tending to shorten all its diameters, especially the transverse diameter. The axis formed by the trunk and head of the child, which go to make up the resisting base of the triangle, is flexible; therefore B and C are brought nearer to each other. This process we may call the 'balling of the child.' When the utmost approximation has been attained in this manner, we still have the entire thickness of the head, equal to four inches and only slightly compressible, plus the thickness of the body, which, after all possible gain by compression is effected, is equal to at least two inches more. The sum will exceed by an inch or more the available space in the brim. Or, taking by circumferences, which is the more exact method, we should find that the circumference of the feetal ball exceeds that of the brim, 14.60 inches, by three inches or more.

As a general rule, it may be stated that no part of the child, except a leg or an arm, can traverse the pelvis along with the head, and even this not without difficulty. The head alone is quite large enough to fill the pelvis. One result of the great compression exerted by the concentric contraction of the uterus is to cause such compression npon the chest, abdomen, head, and neck of the child, and so to compress the placenta and cord, that the child is asphyxiated and killed. It is simply squeezed to death. The contraction of the uterus, although evincing returns of spasmodic violence, rarely remits enough to allow of the restoration of the placental circulation at recurring intervals. The death of the child, leading to loss of resiliency, will, after sufficient time, admit of a much further degree of compression or 'balling,' and then possibly the child may be so doubled up and moulded that it may enter the pelvis.

One condition, therefore, of spontaneous evolution is the death of the child. If not already dead at the commencement, it will almost certainly, if of medium size or larger, be killed in the course of the process. Other conditions are, a child below the normal size, monsters defective in resiliency and in parts to which the normal physical properties are due.

Herein lies a great distinction between version and evolution. A living child is favourable to version, a dead one to evolution.

The process of spontaneous evolution, also described by

Denman and others before him, was afterwards explained by Douglas, who put forward his explanation as a correction of that of Denman under the erroneous impression that Denman's description was not based upon correct observation and interpretation. Douglas was right as to the affirmation of spontaneous evolution, and wrong as to negation of spontaneous version. Denman was not only right as to spontaneous version, but also as to spontaneous evolution. Both processes are now well understood. Kleinwächter gives an excellent illustration

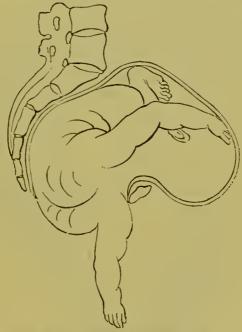


Fig. 38.—Evolution in progress. (R. B.)

of spontaneous evolution in process in a frozen corpse. We select a similar illustration from Chiara.

Spontaneous evolution from the first position proceeds as follows:—At first we have the oblique position of fœtus and uterus represented in fig. 34. Secondly, strong flexion of the head upon the trunk and descent of the shoulder into the pelvis, fig. 37; the head is in one iliac fossa, the breech in or approaching the other. At this stage, commonly, the membranes burst, and the arm falls into the vagina, the hand appearing externally. Thirdly, increased descent of the shoulder and protrusion of the fore-arm. If the child is alive at this stage, the protruding hand and arm become greatly swollen and

cyanosed, livid, from the pressure upon the veins in the axilla against the pelvic wall. This swelling, then, is evidence of life. Another correlated fact is that at this stage the cord frequently comes down and may be felt pulsating. It is apt to be washed down by the rush of liquor amnii, if the membranes burst before the shoulder and chest fill the pelvic brim. The body then doubling or balling under compression, the shoulder jammed against the symphysis, the lower side of the chest bulges more and more, and presents under the pubic arch. The bent trunk is forced lower into the pelvis, is followed by the breech, which finds accommodation in the sacral hollow. This brings about a change in the relation of the child to the pelvic diameter. From transverse, as above the brim, the child now approaches the conjugate diameters; the head comes more over the symphysis. Then, lastly, comes the movement in a circle of the body round the fixed shoulder. The side of the trunk and of the breech sweep the concavity of the sacrum and the perinæum; the legs follow. When the whole trunk is born, the movement of restitution is effected, the back turning forwards, the belly backwards. The head escapes from its fixed position above the symphysis; the chin turns downwards; the occiput looks upwards to the fundus uteri; the nucha is turned to the right foramen ovale. The head enters in the left oblique diameter; it takes the rotation movement in the pelvis, the occiput coming under the pubic arch. Then the movement in Carus's curve is executed; the chin first appears, followed by mouth, nose, and forehead, which successively sweep the perinæum. The occiput, which had been applied to the symphysis, comes last. The left arm usually escapes soon after the emergence of the trunk. So strict is the subjection throughout this process to the laws which govern the mechanism of ordinary labour, that Lazzati does not hesitate to describe spontaneous evolution 1 as the natural delivery by the shoulder.

The lower segment of the uterus expands slowly, continues rigid; the vagina becomes tumid, congested; the vulva presents similar characters. The perinæum is put upon the stretch, and is likely to undergo laceration.

The case described is the most common form of spontaneous

¹ Del parto per la spalla, 1867.

evolution. It is the type of the rest. Keeping its mechanism well in mind, there will be little difficulty in tracing the course of spontaneous evolution when the child presents in any other position.

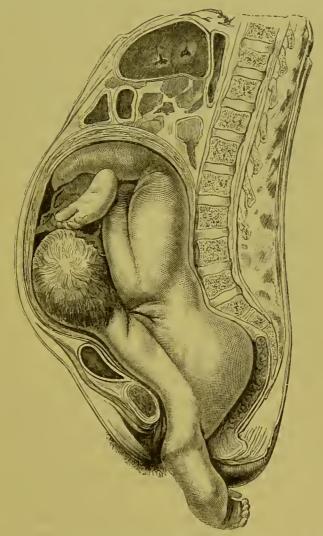


Fig. 39.—Chiara's frozen section. Shoulder presentation in process of spontaneous evolution, conduplicate corpore.

Such, in brief, is the description of spontaneous evolution. Were it more often justifiable to wait and watch the efforts of Nature, we should probably not seldom enjoy opportunities of observing it; but the well-founded fear lest Nature should break down disastrously impels us to bear assistance.

Spontaneous evolution may be accomplished by the head

traversing the pelvis first. The case is indeed rare, but the process and the conditions under which it occurs deserve attention. The essential idea of spontaneous evolution is that the presenting shoulder remain fixed, or at least should not rise up out of the pelvis into the uterus. Therefore, if the head comes down, it must do so along with the prolapsed arm. This simultaueous transit of the head, arm, and chest can hardly take place unless the child is small. If the child is very small the difficulty is not great. If the child be moderately large, it will be far more likely to be born according to the process above described and figured. But some cases of head-first deliveries have been observed. Pézerat relates la case that seems frec from ambiguity. The child was large, the shoulder presenting. A violent pain drove the head down. Fichel de Flichy² gives two cases. Ballochi relates one.3 Robert Barnes has seen an instance of the kind. Lazzati and Monteggia held that in such cases the descent of the head was the result of traction upon the protruding arm. Fielding Ould relates the following:-He was called to assist a midwife who had been pulling at the child's arm, which came along with the head. The head was so far advanced that it could not be put back in order to come at the feet. However, after an hour of excessive toil, he brought forth a living child with a depression of the parietal and temporal bones proportional to the thickness of the arm. Next morning the bones had recovered. Mother and child did well.

What are the conditions required for the execution of spontaneous version? We are now in possession of at least some of the facts necessary to enable us to answer this question. It is probable, however, that some of the conditions are not yet understood. Certain it is that we are hardly yet in a position to predicate in any given case of shoulder-presentation, seen at an early stage, that spontaneous version will take place, as we might be if all those conditions were known and recognisable. They would be more familiar if the law to turn were not laid down in such imperative terms; if the dread of evil as the consequence of neglect of that law were not so overwhelming. For if Nature be always superseded, if the physician always resort to artificial turning as soon as he detects a shoulder presenting,

¹ Journal Complémentaire, t. xxix. ² Observations Medico Chirurgicales. . ³ Manuale completo di Ostetricia, 1859.

how can be obtain sufficient opportunities for discovering the resources of Nature and how she acts in turning them to account?

The principal conditions, however, seem to be: 1. A live child, or one so recently dead that the tone or resiliency of its spine is still perfect. 2. A certain degree of mobility of the child in utero. 3. Strong action of the uterus and auxiliary muscles. A roomy pelvis does not appear to be especially necessary. The retention of some amount of liquor amnii may facilitate mobility. It most frequently takes place at the beginning of the dilatation-stage, when the fœtus is freely movable. It is effected by the restitution action of the uterus.

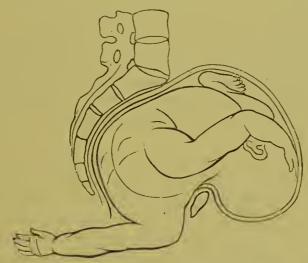


Fig. 40.—Showing Process of Spontaneous Evolution (R. B.). The arm is laid horizontally to save space on the page.

Spontaneous version is not likely to take place when the shoulder has been driven down in a point with a part of the chest-wall low in the pelvis, and the uterus is strongly grasping the fœtus in every part, bending its long axis by approximating the head and breech. It is not likely to take place when the head has advanced towards a position above the symphysis pubis, indicating that the movement of rotation has advanced. Several observers, however, have witnessed self-turning when the arm has protruded. Spiegelberg has seen it twice. But the practical question will arise: Is spontaneous version so likely ever to occur that we shall be justified in trusting to Nature? Ample experience justifies an answer in the affirmative. But

the great lesson taught by the observation of the phenomena of version is this: If Nature can by her unaided powers accomplish this most desirable end, we may by careful study and appropriate manipulation assist her in the task. We shall be the better ministers to Nature in her difficulties, as we are the better and humbler interpreters of her ways. 'Natura enim non nisi parendo vincitur.'

The application of this principle and of the preceding study will be discussed when we have to treat of the operation of Turning.

Diagnosis, Course, and Treatment—Dangers to Mother and Child.

The diagnosis, consisting mainly in recognising the malposition, resolves itself nearly into that of the presentation. The question of prognosis—that is, of estimating the probability of the case being concluded by Nature's operations, spontaneous version, or spontaneous expulsion—must be governed by the considerations already set forth, and by the conditions of the individual case.

The treatment may be very important. It consists obviously in aiding Nature in the task she is engaged in. In cases favourable to probable cephalic version, the physician takes note of the obliquity of the uterus and assists in rectifying it. For example, if, as is commonly the case, the fundus is inclined to the right, he applies pressure to the fundus on the right side, directing it towards the median line, whilst at the same time, by the palm of the other hand applied to the opposite or pelvic end of the uterus, he pushes this to the middle line. Thus gentle, steady pressure applied simultaneously to both poles of the uterus, the axis of the uterus and of the child is brought into due relation with that of the pelvis, and the head is carried to its proper place over the brim. Or the bi-polar principle may be applied in another way-namely, by pulling down the cervix uteri from within, by hooking the forefinger into the os uteri, whilst pressure is exerted on the fundus externally towards the median line. If, when due relation is attained, the membranes are ruptured, the restitution force of the uterus will aid in securing the head in the brim. If this be found doubtful, the forceps should be applied. The course of the labour is

then greatly under the command of the physician. The posture to be observed by the woman should be that which favours gravitation of the fundus uteri towards the median line.

This question and the cognate one, how to aid spontaneous version by the breech, will be further discussed when describing 'Versions.' If obliquity of the uterus and moderate deviation of the head to the side of the brim be observed before the advent of labour, things may be brought into due relation by similar external bi-polar manœuvres, and secured there by judicious padding at the fundus, and in the iliac fossa maintained by a roller. This has been practised successfully by Flamant, Osiander, Wigand, d'Outrepont, ourselves and others.

How to aid spontaneous evolution will be described when treating of version under 'Dystocia.'

Danger to mother and child.—The spontaneous version is favourable to recovery of mother and child. The process, being, in fact, a return to the conditions of natural labour, is therefore propitious to both. This applies especially to cephalic-version. The risk attending breech-version is also small to the mothers, but the risk to the child is likely to be the same as that encountered in ordinary breech-labours.

The danger attending spontaneous evolution is serious. As we have seen, the process commonly postulates a dead or immature child to begin with, or its destruction during its execution. A very small child might pass alive through a roomy parturient canal. Simon 1 says that 14 out of 125 children survived, and in some of these the child was well developed. The danger to the mother exceeds that of ordinary labour. She has to run the gauntlet of rupture of the uterus, of exhaustion, of injury to the bladder, of over-wrought nervous and vascular tension at remote points—in short, all the dangers of dystocia arising during the labour and consequent upon it.

It is not easy to state these numerically. The number of cases uncomplicated by accident and by treatment are too limited to admit of those seemingly precise, but really most deceptive, constructions called statistical statements. But Simon notes only 3 maternal deaths out of 125.

Presentation of the limbs along with the head.—We have already said that, as a general rule, the head is large enough to

¹ Die Selbstentwickelung, 1867.

fill the pelvis by itself. It does not readily tolerate any other part in company. But it occasionally happens that a hand, or even an arm, may descend alongside the presenting head. Such cases may be said to be 'missed shoulder-presentations.' A little more descent of the arm or at a little earlier period, and the head might be deflected out of the brim, and the shoulder might take its place.

It is not a very uncommon event, however, for a hand to come down by the side of the head partly engaged in the brim. Generally, as soon as the head descends so low as to get fixed in the brim, the hand or arm, meeting more resistance from the lower segment of the uterus and the side of the pelvis, recedes, and the head then proceeds alone.

When the arm is prolapsed, this is generally due to imperfect filling of the lower segment of the uterus and of the pelvic brim by the head; as happens when the position of the uterus is oblique, or the head is small, or the shape of the brim is irregular, as when it is reniform. Premature labour and death of the fœtus are favouring conditions. Under such conditions the arm is likely to be washed down when the liquor amnii escapes with a rush. Under ordinary proportions, it is not a very rare thing to see the hand, and even a part of the fore-arm, come through the outlet alongside of the head. But there may be considerable delay and difficulty if the arm descends low in the anterior wall of the pelvis. Such a relation may impede the rotation of the head, and lead to great bruising of the arm. The least troublesome relation is when the arm is placed in the hinder side of the pelvis; it then finds room in the space on the right or left of the promontory, and may not seriously interfere with the course of labour.

The treatment falls within the scope of the operations for dystocia, and will be described in the section on Version. We are in this place concerned with the more strictly physiological cases.

Complicated Presentations.

Prolapse of the umbilical cord is a frequent complication of oblique and breech presentations, of placenta prævia, premature labour, excess of liquor amnii, indeed of all labours in which the lower segment of the uterus below Bandl's ring and the brim

of the pelvis is imperfectly filled by the presenting part of the child. This subject also will be more fully described in the section on Version.

Presentation of the placenta.—This is described under 'Hæmorrhage.'

Presentation of a polypus or tumour.—This will be described under 'Dystoeia.'

Dorsal displacement of an arm also falls under 'Dystoeia.'

Twins.

The history of twin-gestation has been partly drawn in the chapter on the Physiology of Gestation. We refer to this section (see p. 258, Vol. I.) as an introduction to what follows on the clinical aspects of labour with twins.

In many cases the labour is premature, eoming in the eighth or ninth month. The combined weight of the two feetuses, and therefore of the space they occupy, will commonly exceed that of a single feetus, even of a more advanced gestation. Thus, taking the weight of a mature single feetus at term to be nine pounds, the combined weight of twins, at the end of eight months, may be twelve pounds or more. Add to this excess of weight and bulk of the feetal element, the increased quantity of liquor amnii, the two placentas, and the larger uterus, and it is not surprising that tolerance of the gestation is exhausted at an earlier period than in the ordinary course of single gestation. Perhaps also, under the double stimulus, the vascular and nervous tension is greater, and so the explosion of labour is precipitated. One factor determining labour is, no doubt, the distension of the uterus; and the limit of distensibility is sooner reached in twin-gestation. account given (see Vol. I. p. 258) of the disposition of the fœtuses in utero supplies the clue to the character of the labour. Thus when the feetuses are enclosed each in its own fruit-sac, the cords and limbs are usually preserved from mutual entanglement. Then the children will be born suecessively without difficulty.

There are two chief dispositions of the children: 1. In this case both the fœtuses are disposed head lowermost, but on a different level. 2. The fœtuses are reversed—that is, one occupies

the lower segment of the uterus, its head lowermost over the pelvic brim; the other fits itself to the uterus and its fellow by taking the opposite posture—that is, breech downwards, head at fundus uteri. Each fœtus is in its own sac; one lower than the other.

The position of the fætuses at labour. Spiegelberg, summing up 1,138 twin-labours analysed by Kleinwächter and Reuss, found that both presented by the head in 558 instances, or very nearly one-half; that one presented by the head, the other by



Fig. 41.—Showing one disposition of twins. (Ramsbotham.)

the breech, 361 times, or nearly one-third; that both presented by the breech 98 times; one by head and one transversely 71 times; one breech and one transverse 46 times; both transversely 4 times.

Thus, of 2,276 children, the head presented in 1,548, the breech in 603, and there were 125 transverse-presentations.

It is thus seen that, although head-presentations predomi-

nate, the proportion of breech and transverse-presentations greatly exceeds what is observed in single births.

In both cases, one ovum presents at the cervix uteri and engages in the brim of the pelvis at a time. Indeed, under the law of accommodation, one feetus will necessarily push the other aside during gestation, or at the commencement of labour. Thus, at the beginning twins may not be suspected. The membranes and a head present in the ordinary way. The dilatation-period is often more tedious. The force has to be transmitted to the presenting bag of membranes through the other bag. Force is therefore wasted. Besides this, the uterus is over-distended and its contractile power is impaired. When the presenting bag is ruptured, and the liquor amnii has wholly or partially escaped, there may still, for the reasons stated, be some delay in the expulsive stage; but not seldom the uterus acts vigorously and the first child is born quickly. When this is delivered, its cord should be tied.

Course of labour with twins. Taking the case in which the fœtuses are disposed head down, we find that one presents at a time. The membranes burst, the head engages in the pelvis much as in single labour, and the child progresses through to birth. It sometimes happens that the second child follows very quickly, so that there is no time or occasion to consider diagnosis or treatment. But sometimes the first child is delivered slowly. Occasionally its placenta follows. If it should not do so at once, it is held to be good practice to tie its cord, separate the child, and wait a while. The reason for tying the cord is the possibility of anastomosis between the placentas of the two fœtuses, so that if we divided one cord without tying it, blood might be drained off from the placenta, and the child still in utero and dependent upon the placental circulation might be destroyed. This possibility, slender as it is, must be borne in mind.

An interval of repose follows the expulsion of the first child. It is observed that the abdomen and the uterus have not shrunk as is usual after single birth; and on palpation the outline of the still large uterus may be felt; the parts of another child may also be made out. Examining internally, a second bag of membranes is felt occupying the dilated cervix uteri, and through it the presenting part of the child; in the

ease under consideration, it is another head. The passages having been fully dilated or "canalised" by the first child, it might be expected that the second child would pass quickly. It is often so. But occasionally the labour lingers, from uterine or systemic exhaustion. If not aided, the delivery of the second child may be delayed for several hours. Cases are reported in which the second child has not been born until one, two, three, or more days later.

When the second child is born, its cord is tied in the usual manner. There is again an interval of repose, to prepare for the placental period. It is not desirable to hurry this stage. But it is especially useful to maintain steady pressure upon the body of the uterus. When the contractile property returns, the pressure should then be concentric—that is, the uterus should be grasped by the two hands, as described by the title of 'Expression of the Placenta.'

The over-distended uterus rarely contracts so powerfully to detach and cast the placentas as it does in single labour. 'Expression,' therefore, is especially called for. In this way the placentas may be detached and squeezed out into the bed. In some cases the placentas come separately; in others, attached in one cake. But it is necessary to be doubly careful so to compress the uterus from side to side as well as downwards, as to avoid causing inversion of the organ.

The placentas expelled, steady pressure should still be kept up on the fundus uteri, at first by the intelligent hand, then by pad and binder. The liability to hæmorrhage in plural labours is greater, from four causes: 1. There is probably a greater volume of circulating blood with increased vascular tension; 2. The area left bare by the double placenta is greatly larger; 3. The uterus is thinner and weaker; 4. The shock of the labour is greater, due chiefly to the sudden loss of the double burthen. We have seen that Gassner estimates the loss in single labour, made up of child, liquor amnii, placenta, blood, and excretions, at a little more than ten per cent. of the body-weight.

In the case of twins, the proportional loss to the body-weight is higher. The sudden removal of this mass from the pelvis and abdomen must exercise a corresponding impression upon the nervous and vascular systems.

So far labour with twins follows the ordinary course of single

labour, the difference being that one ovum presents first and that another follows. Such a labour falls under 'Eutocia.' But things do not always proceed so smoothly. The fœtuses may obstruct each other in the labour, and give rise to serious forms of 'Dystocia,' requiring operative aid to release them and to effect delivery. These complications and the treatment will be described in connection with the appropriate operations.

Triplets.

Labour with triplets differs mainly from labour with twins in being likely to be even more premature. The children may follow each other at long intervals, but sometimes they succeed rapidly, and it is even possible for two of them to engage in the pelvis at the same time. The placentas may be distinct. In one case observed by ourselves three placentas came away quite separate from each other. They may, however, be united at their margins. A placenta may present after the birth of one child, and come away before the next child engages in the pelvis. Entanglement may occur as in twins, but, the children being generally smaller, great difficulty rarely occurs from this cause. The risk of hæmorrhage is probably greater than in twin-labour, and corresponding care is required in preventing or arresting it.

CHAPTER V.

ACCIDENTS OCCURRING DURING AND FOLLOWING UPON LABOUR. THE HÆMORRHAGES, INCLUDING THE HÆMORRHAGES OF GESTATION: SO-CALLED 'ACCIDENTAL HÆMORRHAGE;' PLACENTA PRÆVIA; POST-PARTUM HÆMORRHAGE; SECONDARY OR PUERPERAL HÆMORRHAGE; THROMBUS OR HÆMATOCELE.

During labour and soon after it certain accidents may arise. The principal accidents that occur during labour are:—

- A. Hæmorrhage, including thrombus or hæmatoma.
- B. Lesions of the parturient canal, as ruptures, lacerations, bruisings of the uterus, vagina, and perinæum; sloughing.
 - C. Fistulæ: vesico-vaginal, recto-vaginal.
 - D. Inversion; retroflexion; anteflexion of the uterus.

The following accidents, although their cause may be traced back to the labour, come into prominence chiefly at variable times after labour:—

- E. Inflammation and loosening of the pelvic joints.
- F. Sub-involution of the uterus.
- G. Various nervous disorders, as paralysis of the uterus, bladder, and intestines. (Puerperal insanity has been described under the 'Diseases of Gestation,' see Vol. I.)
- H. Disorders of the circulation and lungs. (These merge into the 'Diseases of Puerpery.')

This chapter will comprise the history of

A.—HÆMORRHAGE.

In order to present a connected and more philosophical account of hæmorrhage, we here bring together, into one continuous history, the hæmorrhages of gestation, of labour, and

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of pnerpery. The hæmorrhages which break out during these successive epochs of the parturient process have one common foundation. It is true that the conditions which lead immediately to the outbreak of hemorrhage in these three epochs, that the clinical history, and the treatment present distinctive characters. Still, the different characters will be the better understood by studying the hæmorrhages of parturition in their essential connection, preserving the natural order of historical sequence. So shall we more firmly grasp the general facts and laws of hæmorrhages, their physiological evolution, and the principles of treatment.

General Laws and pre-disposing Causes of Hamorrhage.

The chief of these are high nervous and vascular tension; hydræmia; the stimulus of ovulation; the developmental attraction of blood to the pelvic vessels.

Although these factors are most active in gestation, some of them are at work in the hæmorrhages of the non-gravid state. The hæmorrhages of early gestation are strictly analogous to menstruation and menorrhagia. This analogy, if less clearly seen in the hæmorrhages of advanced pregnancy, of labour, and of puerpery, may nevertheless be traced. It is a further illustration of the physiological homology of menstruation and labour already pointed out.

We may first broadly distinguish the hæmorrhages as follows:-

- 1. The hæmorrhages of gestation . Sare hæmorrhages of labour .
- labour . . \ high tension.

 pnerpery \tag{are hæmorrhages of low tension.} 3.

Thus we realise a first distinction.

I. The Hæmorrhages of Gestation.

These group themselves clinically into-

- A. The hæmorrhages of the first three or four months, and
- B. The hæmorrhages of advanced gestation.

A. The Hæmorrhages of Early Gestation.

Many of these are associated as eause and effect with abortion. In tracing the history of abortion we have necessarily referred to these cases. But hæmorrhages occur in connection with early pregnancy which do not necessarily affect the attachments of the ovum. It is desirable to point these out in the first place.

Hemorrhages of early pregnancy not entailing abortion. Under the high vascular tension and pelvic hyperæmia attending gestation, the gorged mueous membrane of the vaginal portion and cervical canal may permit blood to ooze out in quantity large enough to attract attention, and to give the alarm that abortion is impending. This may occur without any lesion of the mueous membrane. But it is more likely to occur when there is abrasion or loss of the epithelial element. In either ease, the hæmorrhage is especially prone to break out at a menstrual epoch. Indeed this is a general law observed in all the hæmorrhages of gestation, and, it may be added, of all hæmorrhages after labour and in the nongravid state. It is the consequence of the increase of vascular and nervous tension at those epochs.

The continuance of hæmorrhages of this kind, although the blood escapes from an area outside that properly concerned in the gestation, may still, by attracting an unwonted flux to the uterus generally, lead to such excess of blood-pressure in the uterine vessels as to induce extravasation in the decidua, and thus lead to abortion.

In this event we see an illustration of one of the laws of hæmorrhage which has a wide application. The law is this: When hæmorrhage sets in from any given point, there quickly follows an attraction of blood towards the point of escape. The blood destined for the system generally is greatly diverted from its equable distribution, and directed in undue force and quantity to the broken point in the circulation. There is, in short, a disorder in the dynamics of the circulation.

One indication, then, in the treatment of all hæmorrhages, especially applying to the ease in question, is to control this perverted action of the circulation. To accomplish this we

seek to lower the nervous and vascular tension, by giving salines, laxatives, and sedatives. Digitalis, and the bromides are extremely useful. Lisfranc insisted upon the value of 'derivative venesection,' that is, opening a vein in the arm; by setting up a new attraction, the current of blood will be diverted from the seat of hæmorrhage. At the same time the tension of the vascular system is lowered. Without recommending empirical recourse to this method, we know that in some cases it has been useful, and it illustrates the law of hæmorrhage. At the same time we examine the seat of hæmorrhage for indications for local treatment.

But there is another form of local disease, almost always giving rise to hæmorrhage, which demands close attention. This is malignant disease of the cervix uteri. In cases of this kind, hæmorrhages, at times profuse, oecur at the menstrual epochs and at uncertain times; copious serous discharges tinged with blood, and often offensive to the smell, being more or less continuous. Pain is not constant. When these discharges are observed, local exploration may reveal the disease by the enlargement of the vaginal-portion, induration, an irregular knobby surface, perhaps ulceration. One event is common: the occurrence or increase of bleeding under the examination. But we must point out that all the conditions mentioned may be found, and yet the case may not be one of malignant disease. We have been consulted on cases so suggestive of eancer that immediate resort to amputation of the diseased cervix, or the preliminary induction of labour, has been strongly urged, and in which the subsequent history proved that there was no cancer. The conditions described are sometimes produced under the simple action of gestation upon a cervix which had previously been the seat of chronic follicular inflammation. The glands or follicles of the vaginal-portion become the foci of inflammatory action; hyperplasia with induration is set up; and then, when the intense hyperæmia of gestation is added, the swelling is greatly increased, the dark purple congestion and abrasion from epithelial shedding enhances the suspicion of malignancy, and the ease is set down as eancer. We have seen all these conditions subside quiekly after labour, and the cervix return to the pale, smooth appearance of health. It will nevertheless sometimes be difficult to differentiate these cases. It might,

perhaps, be stated generally that we should not readily admit the presence of cancer unless it had been fairly diagnosed before the gestation, and unless there is evidence in induration and fixing of the cervix by extension to the vaginal-roof.

It may be reasonably snspected that some cases published as successful examples of amountation of cancerous cervix during gestation were examples of the simulated cancer described above.

The course of gestation complicated with cancer. When things are allowed to take their course, the issue is almost invariably disastrous. The disease is not arrested by gestation; hæmorrhage and exhansting discharges recur; and when labour sets in there is imminent danger of laceration of the cervix, which may extend and cause rapid death. If the woman escape this catastrophe, she still has to run the hazard of traumatic hæmorrhage, which it may be difficult to restrain even by the actual cautery or by ferric chloride. The next danger is from sloughing of the injured tissues and septicæmia. And if she survive all these dangers, she will probably sink at no distant period from the ordinary progress of the disease, the more quickly from the impaired vital powers consequent on labour, and puerpery.

It occasionally happens that, the natural development of the inferior segment of the uterus and of the cervix being prevented by the diseased transformation of tissue, labour at term is postponed, and the fœtus perishes. We have seen a deplorable instance of this kind. A woman who had borne several children was, in her last pregnancy, overtaken by malignant disease of the cervix. It was detected when gestation was advanced. The calculated term had been passed, when profuse fætid discharges and septicæmia set in. In this state she came np from the country, moriband. We found the cervix and lower segment brawny, thick, bleeding, and a most feetid stench; the skull was felt presenting, scalp flaccid, bones loose. She was too far gone to think of Cæsarian section, the more especially as the disease had so extended that Porro's operation could not have been carried out. As the sole hope of relief from the septicæmia, we removed the macerated fœtus, after crnshing down, to offer the minimum of resistance. The brittle, necrosed tissnes of the nterus gave way, and death-not, we believe, much accelerated by the operation—followed in a few hours.

In other cases the fœtus has died and been retained for some time, suggesting 'protracted gestation' or 'missed labour.'

Treatment. This will depend upon the nature and extent of the disease. Three classes of cases may be distinguished:—

- 1. Those in which the disease is strictly localised in the vaginal-portion, and coming under observation near the term of gestation. In these the prospect of delivery with safety is good. There is some danger lest the morbid tissues may rend under the distension of the passing head; but, as a clinical fact, the cervix generally dilates fairly.
- 2. In a second class of cases, the disease still localised and the gestation not far advanced, it will be best to amputate the diseased portion by the *écraseur* or by the galvanic cautery wirc. Thus taken early, we may hope to anticipate the extension of the disease, which, if allowed to go on, might have rendered labour impossible without the infliction of dangerous violence to the parts.
- 3. In a third order of cases, where the disease is more extensive, having invaded the upper part of the cervix and lower segment of the uterus, the true course to adopt is to remove the uterus altogether by Porro's operation. Spencer Wells¹ relates a successful case.

It may even be contended that this radical operation would be best in all cases in which the disease is presumably limited to the uterus.

The hæmorrhages of abortion arise directly from blood being extravasated between the decidua and fætal elements of the placenta, disturbing the utero-placental connections; or from disease of the ovum as in hydatiform degeneration. This subject has been discussed as a part of the history of Abortion (see Vol. I.).

B. The Hæmorrhages of Advanced Gestation.

a. Accidental hamorrhage. By this term is understood simply the hamorrhage that breaks out in the course of gestation, usually before the natural advent of labour, the placenta having grown in its normal site—that is, within

the fundal and equatorial zones of the uterus. In this sense it is distinguished from placenta prævia, which grows greatly or wholly within the lower zone. The distinction is arbitrary and unphilosophical. Every hæmorrhage must have a cause; none can strictly be called 'accidental.' But, bearing this in mind, the term may be retained as a matter of convenience.

Convenience, however, is here, as is too often the case, purchased at the expense of truth. The term 'unavoidable,' as applied to the hæmorrhage of placenta prævia, is much too absolute.

There is, however, sound clinical reason for studying the hæmorrhages that occur during the latter three months of pregnancy, distinguishing those connected with placenta prævia from those which occur when the placenta has grown within the normal boundary.

As we approach the term of gestation, the relations of the placenta to the uterus differ materially from what obtains in the earlier months. The adhesion becomes less intimate; slighter causes determine its premature detachment; and one circumstance which lends special significance and gravity to the hæmorrhages of this period: the liability to partial or complete retention or concealment of the extravasated blood is almost unknown in the first half of gestation. This important practical distinction we certainly owe chiefly to Rigby's definitions. This distinction and the outflowing clinical indications do not seem to have been adequately appreciated by most French and German authors.

Hæmorrhage in the latter months depends essentially upon detachment of the placenta, so that blood flows from the ruptured and bared utero-placental vessels. This general proposition is no less true of the hæmorrhages which arise when the placenta grows to the fundus than it is when the placenta grows to the lower zone.

The immediate causes of detachment of the placenta are: (1) Contractions of the uterus, which disturb and break the relations of surface between uterus and placenta. (2) Under especially sudden determination of blood to the uterus and placenta. (3) External violence.

1. Towards the end of gestation, the muscular fibre of the uterus becomes rapidly developed, and contractility becomes

more and more pronounced. Hence it is that detachment of the placenta is more frequent at this period. Causes that heretofore would have been harmless may now excite active contraction. Some degree of contraction analogous to the peristaltic motion of the intestines may commonly be felt by the hand, especially if it be applied cold on the abdomen. If contraction be excessive or sudden, the placenta may be partially loosened. The smallest extravasation between uterus and placenta will excite further contraction; the separation is increased and more blood is effused.

Gendrin gives the following explanation of the mechanism of detachment of the placenta. The muscular structure of the uterus is disposed in two layers, an external and an internal. The relations of these two layers with the vascular layer account for the influence they exercise in the production of hæmorrhage. Where spasmodic contractions are excited, the intra-uterine vascular plexus being pressed irregularly by these muscular contractions, blood must flow in some points of the placental disc; hence a local congestion which may cause a rupture of the weak venous branches. These contractions, by causing circumscribed puckerings on segments of the uterine globe, necessarily drag upon the placental connections, and may cause their rupture.

2. The second cause may act independently of the first, but with peculiar force when the first is present. Emotion will cause contraction of the uterus; it is also a powerful agent in determining a sudden flow of blood to the uterus. The sudden tension of the vessels, aided or not by contraction of the muscular wall, is relieved by extravasation of blood between placenta and uterus. Kiwisch observed that detachment does not always ensue at once upon the nervous shock, and that flooding may not set in until some hours, even days, have passed. Such cases, we think, may be explained by supposing that a slight extravasation takes place at the time, which, acting as an irritant to the uterus, occasions extended contraction a little later. The utero-placental vessels are of extreme delicacy; they form the weakest point of the circulating system. Sometimes extravasation takes place in the placenta itself-placental apoplexy. This will probably lead to detachment.

3. Violence in many forms may produce similar results. Direct violence, as from blows upon the uterus, usually assigned as the most common cause, acts in an obvious manner. A blow, even if not bearing immediately upon the part of the uterus to which the placenta is attached, may, by repercussion or contre-coup, throwing the uterine wall into agitation or making it contract, cast the placenta. The movements of the fœtus even may excite sufficient contraction. Coitus in some cases has appeared to be the immediate cause. Detachment of the placenta has been known to follow severe vomiting, straining at stool or coughing, standing at hard work at the wash-tub, lifting heavy weights. These causes may act, not only by the violent succussion, but also by producing uterine and placental hyperæmia. But the frequency of violence as a cause is, we believe, much exaggerated. When violence is the apparent efficient cause, there is frequently pre-existing a predisposing cause in disease of the placenta, of the uterus, or of the blood, or liver, or kidney, or lungs, or heart, or general systemic disorder. We may repeat our aphorism: 'The healthy ovum clings to the healthy uterus with wonderful tenacity.

The predisposing causes. This premature separation of the placenta rarely occurs in the young and robust, differing in this respect from the case of placenta previa. It is most common in women past thirty-five years of age, who have borne many children, whose constitutions are worn by sickness and poverty, perhaps by intemperance, whose tissues are therefore badly nourished, wanting in tone, tending to atrophy or degeneration: in short, in the same class of persons who are most liable to rupture of the uterus. In one case we found fatty degeneration of the heart.

Certain diseases dispose to hæmorrhages, and notably to this form. Variola, albuminuria (Blot), leucocythemia (Paterson 1), acute atrophy of the liver, are amongst the most potent. Disease of the liver, by obstructing the return of blood from the pelvic viscera, will necessarily promote hyperæmia of the uterine venous system; whilst the augmented arterial tension incident to pregnancy will throw increased strain upon the point of meeting of the arteries and tissues at the placenta.

¹ Edinburgh Medical Journal, 1870.

Thus the danger of bursting bounds at this, the weakest point of the circulating system, will be very great.

A strong predisposing cause may exist in a morbid condition of the placenta, such as fatty degeneration, fibrinous masses, or atrophy, by which the uniformity of its structure is impaired. A diseased placenta, especially one of unequal consistency, containing solid lumps, will not follow and adapt itself to the varying movements of the uterus and the changing superficial area of the placental site so easily as a healthy placenta does. This cause was pointed out by Robert Barnes in his memoirs on 'Fatty Degeneration of the Placenta.'

A dead fætus, again, may favour detachment by (1) entailing changes of density and other conditions in the placenta. (2) through retrogression of the muscular and decidual tissues of the uterus, (3) by exciting contraction of the uterus as a foreign body would.

Course and symptoms. There may be no premonitory signs. The woman, in her ordinary health, is commonly seized suddenly with (1) pains in the hypogastric region, referred more especially to the fundus or one side of the uterus. This pain is often very severe; (2) shock, even to the extent of collapse, may ensue. The pain is increased on pressure; (3) quickly sometimes, but sometimes gradually, great distension or bulging of the fundus uteri takes place; (4) and with it loss of regularity of form. A projection or bump is felt. The uterus projects more than before into the epigastric region; it communicates a doughy feel; the form of the fœtus is lost at this part. These signs are the result of the stretching of the uterus in a circumscribed part by the accumulation of extravasated blood. The histories of severe cases mostly show that the detachment begins in the middle of the placenta, and proceeds towards the margin under the pressure of the accumulating blood. A cavity is formed for the reception of the blood, partly by inward compression of the placenta, which tends to be separated, and partly by bulging outward of the uterine wall. The placenta, examined after expulsion, is found cup-shaped or concave on its maternal surface, instead of being convex. Oldham described a typical case in which the placenta retained its adhesion all round the margin only,

¹ Guy's Reports, 1856.

a large mass of blood being imprisoned in the hollow formed between uterus and placenta. The placenta is in Guy's museum. (5) A fifth result of the uterine injury and sudden shock is the absence of true labour-pains. The uterus is either paralysed or thrown into disorderly spasmodic action.

It is interesting to note the analogy between these cases and rupture of the uterus. The symptoms often bear a striking resemblance. In both cases there is sudden injury to the uterus. Accidental hæmorrhage may in some cases be regarded as an alternative of rupture of the uterus. Emotion, by causing sudden concentric pressure, may cause rupture. This catastrophe may be averted if the ovum or its attachments give way. The peritoneal coat has been actually torn under the violent stretching—a fact that deserves to be borne in mind, since it has been produced by the similar mechanical process of forcibly injecting air or water into the uterus for the purpose of inducing labour. Evidence of this will be found in the chapter on 'The Induction of Labour.'

We must not always look for external hamorrhage as a sign. Blood, we have seen, is effused; but it may be retained concealed. There are, indeed, the general signs of loss of blood: fainting, blanching, agitation, perhaps deafness or blindness; the skin is cold and clammy; the pulse feeble, dicrotous, or almost extinguished; the features are pinched; the whole aspect indicates suffering and depression. The intensity of these symptoms is commonly greater than can be accounted for by the loss of blood—at any rate, by that which escapes externally. The symptoms, then, are due to the combination with shock.

In some cases, not whole blood, but serum, more or less rcd, oozes out of the uterus and escapes externally. The crassamentum or clot is retained; the serum is squeezed out under compression. This sign, then, is characteristic of internal hæmorrhage and retention. Our attention was first directed to it by E. Calthrop.¹ Hence, when we see a thin, watery blood escaping, we may suspect retention of clot from 'accidental' or 'concealed' hæmorrhage. When the child is born, placenta and black clots come away with a rush.

There is an order of cases in which the symptoms are
Lancet, 1869.

comparatively slight. In these there is no mark of tension of the uterus, and but slight shock or pain. In this order it will generally be remarked that blood escapes externally; and it is to this circumstance that the mildness of the symptoms is due. There are cases in which rupture of the membranes, or even expectancy, is sufficient treatment. There being little shock or exhaustion, the uterus quickly reasserts its power. We believe many of these cases of accidental hæmorrhage are so in appearance only, and that they really are in their essence cases of placenta prævia. A flap of placenta dips down a little way into the lower zone, and this flap becoming detached, blood readily escapes by the cervix uteri. This fact we have often demonstrated by showing that the rent in the membranes was near the margin of the placenta. This fact must be accepted as circumscribing the number of cases of accidental hæmorrhage. Many are in reality cases of placenta prævia. It must, however, be borne in mind that like causes may produce premature separation of placenta, whatever be the seat of its attachment.

Prognosis. Cases of this kind, occurring, as they mostly do, under conditions of reduced power, if not of disease or under violence, where there is little power of recuperation or of resistance, must always be looked upon with anxiety. Death may occur in a few hours, even before delivery, and before there is time to succour. Sometimes the added shock of labour induces fatal prostration; and sometimes further hæmorrhage, following the birth of the child, extinguishes what little strength and hope remained. Safety, then, often depends upon early recognition of the nature of the case.

It is impossible to give an approximate estimate of the risk to the mother. The immediate risk to life is serious; the risks she has still to run if she rally from the immediate shock are scarcely less serious. Secondary hæmorrhage, continuing shock, peritonitis, metritis, septicæmia, present a formidable array of dangers.

The prospect of the child's survival depends greatly upon the extent of the detachment of the placenta and the time that elapses before its extrication from the womb. In the cases allied to placenta prævia, in which only a flap encroaching within the lower zone is detached, the prospect is good, if the right assistance be given in time. But in the eases of concealed hæmorrhage, in which the main bulk of the placenta is detached, the child is generally lost. It perishes of asphyxia, arising from the mother's loss of blood and collapse, even when a portion of the placenta still remains adherent.

It is difficult to estimate the *frequency* of these cases. Goodell, in a valuable memoir, collected 106 cases; of these, 54 mothers perished; and of 107 children, 6 only were known to have been saved. Thus the mortality is greater than in placenta prævia, both for mother and child. The case is even in a higher degree cataclysmic.

Treatment. The first thing to do in all the cases is to rupture the membranes. This, by letting off the liquor amnii, takes off the strain upon the uterine fibre, allows the walls to resume their natural condition, and provokes labour. Even before doing this, and at any time when we see prostration marked by feeble pulse, oppressed breathing, and cold skin, we should rally the patient by the subcutaneous injection of a drachm of ether. This may be repeated every half-hour if necessary. The restorative action of this remedy is often as surprising as it is gratifying to witness.

In some cases, in which the prostration is not marked, rupturing the membranes may be enough. Nature will do the rest. To proceed hastily to forced delivery might prove fatal by adding to the shock. Ergot is of doubtful value. If there is great depression, it may prove inert or add to the depression. Stimulants internally, warmth to the extremities, and

friction are useful in promoting reaction.

This accomplished, the uterus may be enabled to contract, and labour may go on spontaneously. Steady, but not forcible,

support may be applied by a bandage.

The next thing, if labour does not set in fairly, is to dilate the cervix gradually with the water-bags. Before these were introduced, the alternative was to risk letting the woman sink from exhaustion, or to encounter the perhaps greater peril of forcing the hand through the cervix and turning the child to deliver it. Collins says: 'I know of no operation more truly dangerous both to mother and child than the artificial

 $^{^{\}rm 1}$ $^{\rm c}$ On Concealed Accidental Hæmorrhage of the Gravid Uterus.' $Amer.\ Jour.$ of Obstetries, 1869.

dilatation of the os uteri and turning the child.' This opinion, of course, is based upon the operation of forcing the hand through the cervix and then turning. He relates a case in which laceration of the uterus was thus caused. If the hydrostatic bags are used there is no operation more safe. When there is sufficient dilatation, you may deliver by the forceps if the head present; or if the symptoms be urgent, and the child is presumably dead, it will be better to make delivery easier and quicker by perforating the head and extracting by eraniotomy-forceps or cephalotribe. If any other part than the head present deliver by bi-polar turning.

The ruling principle should be to proceed with as little precipitation and force as possible, economising the woman's

strength.

When the child is delivered, the placenta comes away with a mass of clotted and fluid dark blood. It is not wise in these cases to employ kneading the uterus or expression unless with extreme care; and kneading is better avoided altogether. If the placenta does not come readily under steady but gentle compression of the uterus, it is better, after a subcutaneous injection of a drachm of ether, to extract it gently by the hand. As soon as this is done, inject a stream of hot water, 110° F., into the uterus. This will do much to arrest or avert hæmorrhage, and will help to rally the patient's strength. Should this fail and hæmorrhage persist, we must have the courage to swab the interior of the uterus with a solution of perchloride or persulphate of iron, unless we are prepared to let the woman bleed to death. The extreme depression forbids all trust in agents which depend for their efficacy upon a reserve of power in the system. The paralyzed, injured uterus allows fresh hæmorrhage.

PLACENTA PRÆVIA.

Before the time of Levret and the elder Rigby hæmorrhages from placenta prævia and the hæmorrhages described in the preceding section were commonly confounded. The distinction is based upon the following characters. In both cases the hæmorrhage proceeds from the uterine surface, from which the placenta has been detached. In accidental hæmorrhage the

placenta had grown within the normal region of the body of the uterus—that is, above Bandl's ring (see figs. 83, 84, Vol. I.). In unavoidable hæmorrhage, the placenta had grown wholly or in part in the lower segment of the uterus—that is, below Bandl's ring. These two parts we have seen are differently endowed. The body proper above Bandl's ring is capable of more vigorous contraction than the segment below it, and therefore the utero-placental vessels bared on separation of the

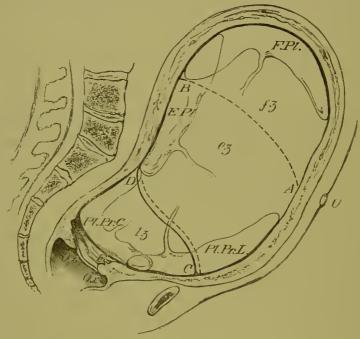


Fig. 42.-Diagram illustrating Barnes's theory of Placenta Pravia. (R. B.)

Division of uterus intozones:—A B. Upper polar circle. CD. Barnes's lower polar circle or Bandl's ring. EF. Circle of os interrum. Ox. Os externum. f.z. Fundal zone. c.z. Equatorial zone. l.z. Lower zone. F.Pl. Fundal placenta. E.Pl. Equatorial placenta. Pl.Pr.L. Placenta prævia lateralis. Pl.Pr.C. Placenta prævia centralis.

placenta are more readily closed. Robert Barnes, who had, on physiological and clinical evidence, anticipated Bandl's anatomical demonstration differentiating these two regions of the uterus, divided the body of the uterus into three zones: (1) the upper, or fundal; (2) the middle, or equatorial; and (3) the lower, or eervical zone. This last zone is identical with Bandl's lower segment.

The theory of unavoidable hamorrhage. Levret and Rigby, who first elearly perceived that this form of hamorrhage

was connected with implantation of the placenta at the lower part of the uterus, did not, however, rightly estimate the conditions upon which the hæmorrhage depended. They held that so long as the labour continued, hæmorrhage would go on, even increasing—that is, the hæmorrhage is unavoidable. The therapentical corollary drawn was that 'manual extraction of the fœtus by the feet was absolutely necessary to save the life of the mother.' Almost all subsequent authorities concurred in accepting the doctrines and in adopting the practice of Levret and Rigby.

Denman is absolute in his sentence. He says: 'It is a practice established by high and multiplied authority, and sanctioned by success, to deliver women by art in all eases of dangerous hæmorrhage, without confiding in the resources of the constitution. This practice is no longer a matter of partial opinion, on the propriety of which we may think ourselves at liberty to debate.'

Ingleby expresses the theory thus: 'And thus the placenta will undergo a continuous separation, corresponding to the successive expansion of the neck, until nearly the whole of the surface is dissevered from its uterine connection. From this it is evident that, when the placenta is affixed either to the cervix or os uteri, whether wholly or partially, the vessels will become exposed on each successive detachment, and the ultimate safety of the patient will depend upon delivery by turning the child, excepting, perhaps, in two peculiar states, in which rupture of the membranes is the only treatment offered to us in one case, and the safest and therefore the most eligible in the Pain, efficacious as it is in the accidental form of hæmorrhage, unless adequate to the expulsion of the child, is neither to be expected nor to be desired to any material extent in the unavoidable form, as it only renders the effusion more abundant; for though a certain degree of relaxation is necessary, it must be remembered that, in exact ratio as the cervix uteri is successively developed and the os internum progressively dilated, will an additional mass of placenta be detached from its connecting medium, and hæmorrhage be renewed.1

Caseaux says, since the time of Levret the insertion of

1 Uterine Hamorrhage, 1832.

the placenta over the neck of the uterus has been considered as an inevitable cause of hæmorrhage during the last three months of pregnancy and in labour. Gardien says the loss is then of the very essence of pregnancy, and especially of labour.

Nothing can be more hopeless than this theory. Hecatombs of women and of infants have been its victims. The logic is unrelenting, but the premisses are false. Pain—that is, contraction—is the thing wanted to effect labour; but if it comes, and come it must, it brings mortal danger with it Expansion of the cervix uteri is a necessary condition of labour, but the cervix cannot expand without causing more hæmorrhage. Thus Nature is utterly at fault. She is condemned without appeal, without the opportunity of asserting her power.

There were not wanting, however, men who did not accept this theory in all its absolutism. Puzos, Wigand, d'Outrepont, Robert Lee recognised cases in which Nature might be trusted.

Mercier seems to have been so struck with the occasional absence of hæmorrhage in placenta prævia that he wrote an essay under the title, 'Les accouchements où le placenta se trouve apposé sur le col de la matrice sont-ils constamment accompagnés de l'hémorrhagie?' Caseaux recognised cases of dilatation of the neck in which 'not a drop of blood' was lost.

In 1847 Robert Barnes first sketched the new theory of placenta prævia, which he subsequently, in various publications, demonstrated by abundant physiological and clinical evidence. This theory will be now set forth. He began by dividing the uterus into three zones.

Testing this division of the uterus into zones, physiologically, we may find obvious reasons why the placenta is usually implanted within the two upper zones of the uterus. Some of these are: (1) to insure due circulation between the uterus and placenta during labour, interrupted only during active contraction; (2) to admit of equable casting off of the placenta after uterine contraction; (3) to leave the lower zone of the uterus free from vascular hypertrophy, this being the part which has to bear the violence of distension and bruising attending the passage of the child; (4) to preserve the placenta from injury and detachment during the latter end of gestation and during labour. Of these two zones, the upper, or fundal, is

the more propitious, as it most completely ensures the conditions set forth. The fundal seat then is the most natural. It is $\kappa \alpha \tau' \stackrel{?}{\epsilon} \xi o \chi \mathring{\eta} \nu$ the region of safe placental attachment. The equatorial space between the upper and lower polar circles is the next in point of safety. It is the region of equatorial placenta. This placenta is not liable to previous detachment. Attachment here may, however, cause obliquity of the uterus, oblique position of the child, lingering labour, and dispose to retention of the placenta and post-partum hæmorrhage.

Below the lower circle is the lower zone, which we have occasionally called the 'cervical zone,' since it touches the cervix below. But since this term has seemed to some ambiguous, and has apparently raised the idea, nowhere justified by the text, that the placenta grew within the true cervical cavity, we here use the term 'lower zone.' This is the region of dangerous placental attachment. All placenta fixed here contravenes the four reasons why Nature usually plants the placenta within the two upper zones. During gestation the head, if presenting, is constantly pressing upon the placenta within this lower segment; during labour the head presses still more forcibly upon the placenta, bruising it, perhaps detaching it; and the child has to be driven through the lower segment and cervix, enlarged and more vulnerable by excessive vascular hypertrophy, thus predisposing to the ills of laceration, hæmorrhage, and septicæmia. Lastly, it will appear that, since this lower segment must be dilated to give passage to the child, retraction or shortening must occur, and this is incompatible with the preservation of the cohesion between the uterus and the placenta within this zone. In every other part of the uterus there is an easy relation between the contractile limits of the muscular structure and that of the cohering placenta. Within this lower region the due relation is lost.

The lower polar circle, then, is the physiological line of demarcation between prævial and lateral placenta. It is the boundary-line below which we have spontaneous placental detachment and 'unavoidable hæmorrhage'; above which spontaneous placental detachment and hæmorrhage do not occur.

This lower circle or physiological boundary-line between safe and dangerous placental attachment, demonstrated by Robert Barnes in 1847, is identical with Bandl's ring. It is interesting to note how closely this discovery, flowing from clinical and physiological study by Robert Barnes, and that subsequently made by anatomical study by Bandl, confirm each other, and demonstrate what really constitutes placenta prævia.

The exact position of the lower polar circle or boundary, the line between hæmorrhage and safety, can be determined with considerable accuracy. By physiological necessity the lower segment of the uterus must open to an extent corresponding to the circumference or equator of the child's head in order to permit of its extrusion. Beyond this extent there is no physiological necessity for expansion, and it does not expand. Now, by noting the amount of recession or shortening of the lower segment to reach this extent of expansion, we shall obtain the exact measure of the original depth of the lower zone—that is, of the region of prævial placental attachment (see fig. 42).

This point may be further demonstrated by the following simple proceeding. Take a feetal skull, and, marking the left parietal protuberance for a centre, stretch an indiarubber ring over the circle of greatest circumference of the skull, preserving it at equal distance from the centre. This ring will represent exactly the greatest expansion of the lower segment and cervix necessary for the passage of the head. To this extent the parts must expand; beyond this they need not and will not expand. It therefore marks the limit between the lower and equatorial portions of the uterus.

If we now measure the distance between the presenting parietal protuberance of the fœtal head and any part of the line of greatest circumference, we shall have the ntmost extent of the lowest zone. In a full-sized fœtal head this is about 3 inches or 8 cm. If we now describe a circle within the womb at 3 inches from the undilated os internum, we shall have drawn the lower polar circle. This is nearly exactly what the finger passed inside the womb can do.

We believe, however, that the boundary-line of safety is often practically reached before the expansion of the month of the womb has reached the full diameter of the child's head. We have observed that the hæmorrhage has completely stopped when the os uteri had opened to a diameter of from 2 to 3 inches.

This, the original statement of Robert Barnes's discovery of the distinctions between the upper part and the lower third of the uterus, and the boundary-line defining the limit of expansion of the lower segment and of placenta prævia, should be compared with the anatomical description of Bandl's ring and lower segment, and with the following extracts from Spiegelberg and Duncan.

Spiegelberg confirms Robert Barnes's discovery, stating the case in the following manner 1:- 'The expansion of the lower segment of the uterus is greatest at the points which lie nearly at right angles to the axis of the organ, and thus in nearest proximity to the os internum; the expansion lessens the higher these points lie, and the more parallel they run with the uterine axis. This parallelism begins at a distance, at the highest of 6 cm., from the middle of the os internum, measured in a continuous line, from 4 cm. in perpendicular distance. A circle drawn at this boundary transversely across the uterus has a diameter of about 11 cm., and this is enough to permit the fætus to pass. Thus there is no further expansion above 6 cm. from the middle of the os internum. Thus the placenta is prævious when it runs over partially or wholly in the segment thus marked out; the necessary effect of the last expansion at the time of labour is the separation of the placenta, and this is as physiological as is the separation at the normal site through shortening of the adhesion-surface in consequence of concentric contraction.'

Duncan says: 2 'At about $2\frac{1}{2}$ inches from the vertex (the os internum) the diameter of the uterine cavity is 4 inches, and this is about $1\frac{1}{2}$ inches above the vertex, measuring along the uterine axis. A canal of 4 inches in diameter is large enough to transmit the fœtus. There is, therefore, no need for expansion to any considerable amount above that circle of latitude, which is distant $2\frac{1}{2}$ inches, measured along a meridian from the centre of the internal os.' There is some difference in Duncan's estimate of the height of the extreme diameter from the os internum. He gives $2\frac{1}{2}$ inches; we give, approximately, 3 inches, our estimate being based on measurements

¹ Lehrbuch der Geburtsh. 1878.

² Contributions to the Mechanism of Natural and Morbid Parturition, 1875. (Memoir date, 1873.)

made on the fœtal skull from the parietal protuberance to the equator, a method which we submit is physiologically true, as defining the circle of necessary dilatation. This difference does not affect the confirmation afforded of Barnes's discovery. But in another passage Duncan bears clearer testimony: 'Barnes, however, has distinguished himself by the care with which he has justly insisted on the natural limit of spontaneous premature separation, and has shown that it is not the case, as Churchill says, that the more the labour advances the greater is the separation, the utmost limit of separation being reached before the first stage of labour is completed.'

When the dilatation of the cervix has reached the stage at which the head can pass, and when all that part of the placenta which had been adherent within the lower zone is detached, and if, as is the constant tendency of Nature to effect, the intermitting active uterine contractions arrest the hæmorrhage, a stage is reached when the labour is freed from all prævial placental complication; the lateral or equatorial portion of placenta retains its connection, supporting the child's life. The labour henceforth is a natural labour. The bleeding stops, owing partly to the tonic continuous retraction of the lower uterine segment, which closes the mouths of the vessels, and favours thrombotic plugging.

This is the course which Nature strives to accomplish, and not seldom does accomplish. We have frequently verified it at the bedside. Many cases are recorded by old and recent authors in which this course was successfully accomplished, although the narrators failed to interpret the phenomena correctly. If observations in point are not more abundant, it is simply because men, acting servilely under the thraldom of the 'unavoidable hæmorrhage' dogma, fear to let Nature have a chance of vindicating her powers. The instant resort to the accouchement force interrupts the physiological process. We can see no more.

Description of the Varieties of Placenta Prævia.

Four forms may be distinguished:—

1. The complete or so-called central placenta. The os internum uteri is quite covered by placenta. This rises on all

sides up from the os as from a centre, occupying a complete ring of the lower zone. In this form the examining finger touches the placenta itself.

- 2. Occasionally the area occupied by the placenta extends not only over the entire lower segment of the uterus, but rises up on all sides, covering all the equatorial zone as well, and leaving only a small area at the fundus free. Such a case we have seen and figured. The woman died under the hands of a midwife. We removed the uterus with placenta attached as described, and took it to the College of Surgeons.
- 3. The lateral placenta. The placenta dips down on one side of the lower zone, so that an edge reaches the os internum without passing over it. In this form, the finger, on examining, touches the bag of membranes.
- 4. The partial placenta pravia, called by some placenta lateralis. A flap or margin of placenta descends below Bandl's ring, but does not come down to the os internum. It has encroached within the lower zone. In this form the examining finger touches the bag of membranes.

The second form may usually be verified during the labour by feeling the edge of the placenta and the continuous bag of membranes, if this bag be still unbroken; and, if burst, the fingers may make out both maternal and fœtal surfaces of the placenta. After the expulsion of the placenta, the two latter forms are demonstrated by noting the position of the rent in the membranes in relation to the lower edge of the placenta. The distance between the rent and this edge gives, as Levret, Maygrier, Hugh Carmichael, Von Ritgen, and numerous observations of our own show, the exact distance of the edge of the placenta from the os internum.

We find it stated in our note-books that in twenty-seven per cent. the placenta comes within two inches of the os internum.

Another point of physiological and clinical interest described by Levret was the frequent origin of the cord from the lowermost margin of the placenta. He even said that the origin of the cord held a certain relation to the seat of the placenta. Thus, in fundal placentas the cord springs from the middle, whilst in lateral placenta and placenta prævia it takes its rise lower down in proportion. Thus the cord follows and marks the extent of the descent of the placenta. We have studied this point, and are bound to say that we have found not a few exceptions. The placenta figured (fig. 44) is one. Still, we believe that Levret's law, if not universal, is generally true.

The causes or etiology. It is not possible to lay down any positive exposition of the causes which determine the development of the placenta at the lower segment of the uterus. But we may usefully state some of the more frequently observed associated conditions. Amongst the chief of these is the fact that placenta prævia is much more frequent in pluriparæ than in primiparæ. It is apt to recur in successive pregnancies. Osiander showed the greater aptitude of the ovum to attach itself to the lower segment in pluripare. As might be expected, it occurs more frequently with twins; the double placenta demanding a larger area, there will be more likelihood of encroachment on the lower zone. In some cases the placenta, even single, is unusually thin, and is spread out over a larger area in order to make up for diminished thickness. We have referred to one very striking case of this kind. We have seen reason to believe that, when the placenta grows in the lower zone, it may be flattened out under the continuous pressure of the child's head. Being thus prevented from increasing in thickness, it spreads out in area. But this is not universal, as may be seen in Hunter's figure, which represents a central placenta of the ordinary thickness.

As we have already seen, the chorion is primarily covered uniformly with villi; whilst, on the other hand, the entire surface of the uterus down to the margin of the os internum is clothed with decidua. Hence the two conditions: chorion, provided with the structure to contribute feetal placenta from any part of its surface; and uterus, providing structure to contribute the maternal element of placenta. It is a matter of observation that placenta actually is formed at any part of the uterine surface. What the accidental conditions are that generally determine its development from a limited part of the chorion and a limited part of the decidua, we cannot precisely say. We may conjecture that the decidua at the fundal part is sometimes less healthy, and that the chorion-villi, like the radicles of a plant, will push out in another direction in search of a more suitable soil. Or we may suppose, what is more likely,

that the ovum entering from the fallopian tube is not immediately caught in a fold of decidua, but drops to a lower spot and there becomes attached. It has even been surmised that an ovum, having entered the uterus and dropped to the lower part of the uterus, has become impregnated there, and so grows on the spot of impregnation.

It has been said to be more frequent in women subject to

It has been said to be more frequent in women subject to hard work. Is it more frequent in the subjects of retroversion of the uterus?

Küneke ('Monatsschrift für Geburtskunde,' 1859) and Sirelius ('Archives gén. de Médecine, 1861) describe cases of placenta prævia, in which the prævious portion was a supplementary placenta. Hecker had pointed out the same thing.

A speculation or hypothesis of Rokitansky, in reference to the origin of placental polypi and fibrinous polypi, deserves notice in this connection. Rokitansky submits that an ovum, after fixing itself in the mucous membrane of the uterus, and after complete clothing with decidua, may be driven down by uterine contractions into the cervical canal; its attachment lengthening into a stalk, the ovum continues to grow in the yielding cervix. Then ensue death of the ovum, hæmorrhage, and removal. In like manner we may conjecture that the ovum, originally grafted near the tubal orifice, may be driven down or pressed down partly into the lower uterine zone, and be there supported partly by shooting out of chorionic villi. This hypothesis would agree with the frequent large expanse of placenta in placenta prævia, and also with the phenomenon of placenta succenturiata.

It is also possible, as we have cited elsewhere, that the ovum may grow within the true cervical cavity.

The frequency of placenta prævia can hardly be stated with any approach to precision. Schwarz, Spiegelberg, Schwörer, and Hegar's collected statistics give, on a total of 562,120 labours, 394 cases of placenta prævia, or about 1 in 1,400.

In 20,084 labours in the Royal Maternity Charity, during

In 20,084 labours in the Royal Maternity Charity, during the five years 1878–1883, there occurred 28 cases of placenta prævia, with 5 maternal deaths. Thus we get 1 case of placenta prævia in 700 nearly. And even this, we believe, is below the reality. In 1,580 cases in the practice of the British

Lying-in Hospital, during the years 1872 to 1881, there were 3 cases of placenta prævia.

Theories of the cause of the bleeding. 1. There is the old one that it results from the expansion or growth of the lower segment of the uterus in the latter months of gestation; or of the cervix, to which the placenta has by some been supposed to grow, exceeding the accommodating capacity of the placenta, and thus, the placenta being detached, blood escapes from the torn utero-placental vessels.

We think it desirable to quote from the 'Obstetric Operations' (3rd ed. 1876) the following appreciation of this view:— 'This doctrine, passed on traditionally, and accepted almost without question, is undoubtedly founded on an anatomical and physiological error. Stoltz clearly showed that the cervix proper contributes in no way to the reception of the ovum. The cervical canal may frequently be felt nearly closed above by the narrow os internum uteri at the end of pregnancy (see Vol. I., pp. 234, 241).

2. Then the question arises as to the cause of the hæmorrhage which breaks out at the time of labour. This is commonly attributed to the active expansion of the lower part of the womb and cervix. Is this consistent with clinical observation? It is an indisputable fact that the hæmorrhage frequently breaks out before there is any expansion of the lower uterus or cervix at all. We have on many occasions felt the os internum so closed as hardly to admit the tip of the finger after severe flooding had been going on. Robert Barnes submitted a theory the very reverse of that generally accepted. He urged that the part endowed with the most active growth is the ovum, the placenta; that the growth of the uterus is secondary upon the stimulus imparted by the growth of the ovum. He inferred that the first detachment of placenta arose from an excess of growth of the placenta over that of the lower region of the uterus to which it was attached; that the structure of this uterine region was illfitted to keep pace with the placenta; hence loss of relation, the placenta shoots beyond its site, and hæmorrhage results. Again, hæmorrhage is most common at the menstrual epochs, and has not necessarily anything to do with labour. Frequently, indeed, labour does not even follow. At the menstrual nisns there is an increased flux of blood to the uterus and to the

placenta. This over-filling of the placenta makes it too big to fit the area of its attachment; it breaks away at the margin, and blood escapes. Under the irritation of this partial detachment, the infiltration of some blood into the soft substance of the placenta, which increases the bulk of the organ, and the insinuation of some blood, perhaps clotting, between the placenta and the uterine wall, active contraction of the uterus may be excited. Then the retracting lower zone may detach more placenta; but this is secondary.

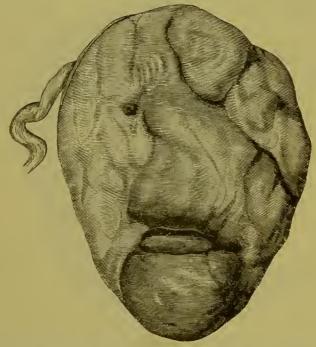


Fig. 43.—The maternal aspect of a Placenta Prævia (½ nat. size). The lower part in form of a flap occupied the lower zone of the uterus. (From a drawing given by Dr. Roper.)

This theory that the first loss of relation between the interus and placenta is due to the excess in rate of growth and periodical hyperæmia of the placenta is strengthened by the analogous case of tubal gestation. Like tubal gestation, gestation in the lower segment of the interus is an example of error loci; both are alike instances of ectopic gestation. In both the ovum grows to a structure ill adapted to harbour it. This want of adaptation consists in infitness to grow with the advancing growth of the ovum. Hence, in the case of tubal or interstitial gestation, there comes a time when the growth of the ovum is

so rapid that the sac, not able to keep pace with it, bursts. This catastrophe also commonly happens near a menstrual period, when increased growth is exaggerated by increased afflux of blood. Robert Barnes drew attention to a fact, now generally recognised, that, before the rupture of the fallopian sac in tubal gestation, discharges of blood by vagina often take place. This is evidence of the ovum outstripping its habitat and getting partially detached. This is exactly what happens in placenta prævia. It is, then, in the history of menstruation

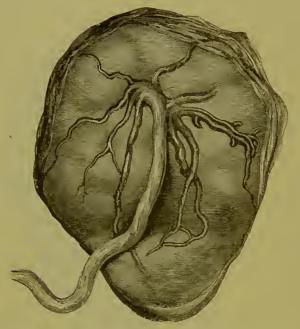


Fig. 44.—The feetal aspect of same placenta. The pravious flap is more clearly shown. The line which distinguishes this flap from the body of the placenta marks the boundary between the lower and equatorial zones of the uterus or Bandl's ring.

and of tubal gestation that we must look for the true lightbearing analogy of placenta prævia.

3. An efficient cause of hæmorrhage, initiative and continuous, we believe to be irregular spasmodic uterine contractions. The presence of the placenta over the os uteri is a cause of reflex irritation; and irritation, once begun, is almost certain to go on, and this in an irregular, metastatic manner. There is perverted polarity.

Another highly probable cause of premature detachment of Clinical History of Diseases of Women.

placenta and bleeding lies in the altered state of the flap of prævia placenta. In some cases (see figs. 43, 44) this portion becomes partially atrophied or indurated, so that its texture loses its natural harmony with the uterine wall. In this state comparatively slight disturbing causes, as shock, succussions, or dynamic changes in the circulation, may cause detachment.

It is reasonable to conclude that, in some cases, bleeding breaks out from similar causes to those which are in operation in the so-called 'accidental hæmorrhage.' Indeed, some of these conditions—as that just mentioned, alteration in the tissue of the placenta—are perhaps more frequent when the placenta is prævia.

4. Dr. Nagel ('Annalen d. Charité-Krankenhauses zu Berlin, 1863') states as a cause of premature detachment of placenta the early rupture of the membranes when the head is low, and os uteri completely dilated. Under these conditions, the advancing head, dragging on the membranes, pulls on the placenta. This may apply to cases of fundal or meridional placentas, as well as to the prævial placenta.

Theories of the Source of the Blood.

We assume, of course, that there is no hæmorrhage until the placenta is detached from the uterus. When this detachment has taken place, there are two bared surfaces presenting mouths of torn vessels. Does the blood flow from the placental surface or from the uterine, or from both? Levret believed that the placenta yielded a portion of the blood. Rawlins, of Oxford,1 says: 'The blood proceeds more from the vessels of the placenta than from the denuded vessels of the uterus.' Professor Hamilton held the same opinion. Kinder Wood, Radford, and Simpson adopted it. If the blood find its exod through the placenta, it follows that, on detachment of the placenta, the vessels torn on the corresponding surface of the uterus get closed, whilst the blood continues to flow on into the placenta at the part still maintaining its connection with the uterus, and that, so flowing on through the placenta, it will escape at the detached surface. Arguing from this basis, Simpson contended that when the entire placenta was separated there would be no

¹ Dissertation on the Obstetric Forceps, 1793.

more bleeding, and hence insisted that the proper practice was to complete the detachment. Summed up, the argument would be, that when the placenta is wholly detached no blood can get into it, and therefore the hæmorrhage ceases, since none comes from the bared surface of the uterus. Robert Lee, with characteristic keenness, asked: 'How is it, then, that furious flooding takes place when the placenta is in the pot under the bed?' Simpson rested his case very much upon the fact that in those cases of placenta prævia in which the placenta is wholly cast off and expelled before the birth of the child, there was little or no hæmorrhage, and that it stopped on the expulsion. If Nature so cast the placenta and stopped the bleeding, so, then, ought the surgeon to detach the placenta, and the same result—arrest of flooding-might be expected. Radford, before Simpson, had been led from similar clinical observations to adopt the same practice.

We are not aware that this hypothesis of the placental source of the bleeding is now advocated by any one of authority. The little evidence adduced in its support is entirely fallacious. In the Lettsomian Lectures (1857), Robert Barnes pointed out that when flooding ceased on the spontaneous total detachment of the placenta, it was because the detachment was effected by active contraction of the uterus; this contraction closes the utero-placental vessels just as it does in post-partum hæmorrhage. And then, again, there are cases in which the hæmorrhage does not stop on total detachment of the placenta, effected spontaneously or artificially. Cases in point are not uncommon. Let us cite one so complete that it cannot be contested. Joseph Clarke relates: 'Mrs. A. was dying when he arrived. hæmorrhage had been immense. She died undelivered; and on examination the placenta had been found entirely separated.' (The italics are in the original.) This is because the uterus does not contract. Ramsbotham, Tyler Smith, and all subsequent writers accept this explanation. That any great amount of blood cannot flow quickly and in gushes through the placenta was proved by the Hunters, who showed that the cavernous structure of the maternal placenta could only permit of a slow uniform current back from the utero-placental arteries to the sinuses. Again, Legroux relates 1 two cases of fatal hæmorrhage

¹ Archives gén. de Médeeine, 1855.

from placenta prævia, in which dissection showed that the fœtus had long been dead. In these, he argued, the placental circulation must have ceased, and that the source of bleeding must have been the uterus. The late Dr. Mackenzie made experiments bearing directly upon this question. 1. Having opened the uterus of a pregnant bitch, and detached the placenta, he observed that the blood flowed freely from the uterus, and that it was arterial. 2. Having partially detached the placenta in a woman, he injected defibrinated blood into the hypogastric arteries. He again observed that the blood flowed exclusively from the uterus, and from the utero-placental arteries. 3. He adduces the recorded observations of many practitioners to show that the blood-flow in cases of placenta prævia is arterial in colour. •

The blood has often been seen flowing direct from the uterine surface in cases of Cæsarian section and of inverted uterus, both with partial and complete separation of placenta. We ourselves bear testimony to these facts. The late Dr. Chowne collected a mass of evidence of this kind. It must further be observed that the languid current through the placenta must be quickly stopped by coagulation. The detached part of the placenta is often found hard and impervious from this cause.

We may, then, fairly conclude that the blood flows mainly from the bared uterine surface, and not from the placenta.

On the other hand, it is probable, as Duncan points out, that bleeding may ensue from rupture of a marginal utero-placental sinus within the area of spontaneous premature detachment, and also from the *circular sinus* of the placenta.

The state of the placenta that is prævia deserves careful study. We have frequently found it presenting blood-extravasations in different states—some, recently effused, still fluid; some in various stages of coagulation and condensation. In some cases the placental tissue is obviously ruptured. This injury takes place either spontaneously during labour or is caused by the manipulations of the physician. In some cases, the flap is thinned as if from compression by the head; the structure has undergone a form of atrophy partly from old effusions, some of which have been decolourised, leaving fibrinous masses such as

we have described elsewhere (p. 562, Vol. I.). The figures (43, 44) represent conditions of this kind.

The question whether a portion of detached placenta can become reunited to the uterus has given rise to discussion. It is obviously very difficult to obtain proof of this from direct observation. The anatomical characters of the normal union between uterus and placenta seem almost to exclude the possibility of such reunion.

Traumatic hamorrhage.—Strictly speaking, the hamorrhage ensuing upon detachment of placenta is traumatic. But this is a physiological and unavoidable traumatism. The traumatism that is now to be referred to is artificial, wrought by the surgeon, and is avoidable, and ought to be avoided. In not a few cases, bleeding may persist after the delivery of both child and placenta. This may be due, first, to the condition already discussed—namely, failure of the uterus to contract; secondly, to laceration of the cervix. This injury may occur under the natural expulsion of the feetus; but it is much more likely to occur under the operations comprised under the term 'accouchement forcé.' Before the views of Robert Barnes prevailed the practice was to deliver at once; and this was often done without much regard to the fitness of the parts to undergo this severe proceeding. So imperious was the dogma of 'unavoidable' persistent hæmorrhage, that the difficulty presented by an undilated os uteri was met by the arbitrary hypothesis which assumes that, in these cases of flooding, the os uteri is, by the flooding, always made easily dilatable. Unfortunately this is not true. Proofs of laceration, of fatal traumatic hæmorrhage from the injured cervix, as the penalty of forcing the hand through the presumed dilatable cervix, abound. But the error is still so prevalent that it is necessary to adduce evidence upon the subject. Leroux says (1810), that before Puzo's time the accouchement forcé was generally performed. The operation was difficult and often followed by a fatal issue. David Davis had met with many examples of even fatal hæmorrhage unaccompanied by any amount of dilatation of the orifice of the womb. He relates a case where very profuse hæmorrhage had occurred, yet the orifice of the womb was but very slightly dilated, and as rigid as if no hemorrhage had been sustained. Labour was induced, taking four or five hours to

expand the os. Living twins were delivered. On the fifth day after labour profuse flooding set in, and caused death. No rupture was found; but the long-continued boring incident to the forcing of the hand had produced contusion, inflammation, and suppuration of the os uteri, and a portion of its tissue, of about the diameter of a sixpence, had sloughed off, and left behind it a deepish ulcer; several branches of arteries were found in the depth of it; and thus was rendered evident the cause of the fatal hæmorrhage. The preparation is in Middlesex Hospital Museum.

Edward Rigby says: 1 'Cases have occurred where the os uteri has been artificially dilated, where the child was turned and delivered with perfect safety, and the uterus contracted into a hard ball; a continued dribbling of blood has remained after labour; the patient has gradually become exhausted, and at last died. On examination after death, Professor Naegelé has *invariably* found the os uteri more or less torn.' Collins and others relate examples in point. The truth is, that so far from the os uteri in placenta prævia being in a state favourable to dilatation, the conditions are often the very reverse.

Tyler, of Dublin, relates a case in which traumatic tetanus followed upon placenta prævia.

Course and Symptoms of Placenta Pravia.

When the placenta grows wholly or in part within the lower zone, its relation to the uterine wall at this part is always liable to be disturbed. It is most probable that some cases of presumed ordinary abortion at the third or fourth month are in reality due to this cause. We have seen (Bandl's, fig. 84, p. 237, Vol. I.) that at the fourth month the distinctive characters of the lower zone are well marked. And we have frequently verified the fact, that in aborted ova of this period there was placental structure within the lower zone. But usually placenta prævia is not recognised as such earlier than the end of the fifth month. At and after this time the woman may be overtaken without warning by a smart flooding of florid blood. This often occurs when she is in bed at rest, even asleep. Probably, in some instances, the immediate cause is

¹ System of Midwifery, 1844.

sexual intercourse. But certainly it is not necessary to invoke external physical agencies. Sometimes the woman is seized when she is out of doors or away from home, so little is she prepared for any accident. These attacks of hæmorrhage are usually quite independent of labour or of uterine contraction. Even those who contend for contraction as the cause admit that the contractions are not felt (Spiegelberg). They occur most frequently at the menstrual epochs. Thus, it is not uncommon to observe a recurrence of these hæmorrhages at intervals of about a month.

A strongly disposing cause is the greater hydrostatic tension in the vessels when the placenta is prævious, than is the case when the placenta grows to the fundus.

Sometimes it comes on after unusual fatigue or emotion. It cannot be doubted that the disturbance of relation between uterus and placenta is brought about by the increased afflux of blood brought to the uterus and placenta at these periods, and under the other influences specified. In the non-pregnant state, emotion alone causes hæmorrhage.

Sometimes the bleeding subsides, and the patient is reprieved for a time. It is even possible that she may go on to the full term of gestation, after having suffered several attacks of hæmorrhage, and be delivered naturally with little loss. But, most frequently, premature labour will be excited either at the first or at the second attack. The seventh and eighth months are especially critical epochs. The bleeding having beguu, some blood is extravasated between the uterine and placental surfaces, the lower edge of the placenta gets thickened and hardened with extravasated blood, and thus the uterus is excited to contraction. When once the uterus is put in action, the termination in labour is highly probable.

The labour is often tedious, marked by inertia. The contractions are generally feeble. This is explained by the following circumstances:—the defective muscular development of prematurity, especially of the lower segment; the disturbed polarity of the muscular action, there being diversion from the upper segment; the unfitness of the lower segment and cervix to expand, owing to immaturity and excessive vascularity.

Another explanation of the protraction is often found in the unfavourable position of the child. Transverse presentations are much more frequent than in ordinary labour at term.

The umbilical cord frequently falls through. For this there are two chief reasons: one is the abnormal presentation, which, not filling the lower segment, allows the cord to drop through; the other is the frequent springing of the cord from the prævial margin of the placenta, so that a loop is ready to fall through the moment the os is sufficiently open and the bag bursts. A gush of liquor amnii washes the cord through.

In some cases of central placenta the child has been driven through the placenta, perforating it. This has been imitated in practice, the obstetrist perforating the placenta, and dragging the child through the hole. The part covering the os internum is sometimes thinned, and bare of placental structure.

Diagnosis.—If examination is made early during the flooding, the os uteri internum is often found scarcely, if at all, dilated more than is usual in pluriparæ—and it is in pluriparæ that placenta prævia most frequently occurs; but the cervix or vaginal portion is commonly thicker than ordinary. The finger, passed up to the os internum, will miss the head or other presenting part of the child, and thus ballottement will be obstructed or prevented, especially if the case be one of placenta centralis. In this case also ballottement may not be made out; but, instead, one feels the quaggy, spongy placenta or a blood-clot. The cervix is generally more tender to the touch, and pain is often felt, during gestation, at the lower segment of the uterus, and on the side to which the placenta grows. Levret says the uterus, instead of being rounded or pointed, is flattened, as if divided into two parts as in twin-pregnancy, but the division is more on one side, causing oblique singularity of form; and in the early months the patient has been conscious of a swelling with pain and hardness in one side. The stethoscope will, as McClintock and Hardy pointed out, often determine the seat of the placenta. Gendrin says a pulsation, not synchronous with the mother's pulse, may be felt at the os uteri. But these points are often difficult to realise.

Placenta prævia has to be differentiated from 'accidental hæmorrhage.' It is usual to teach that in accidental hæmorrhage the bleeding is arrested during a pain, whilst in placenta

prævia the hæmorrhage, although continuing during the intervals, is greatly increased during the pains. Nothing, we believe, can be more illusory than trusting to this distinction. As Legroux pointed out, the hæmorrhagic act is diastolic; the apparent hæmorrhage is systolic, the blood previously effused being expelled during the systole. The hæmostatic act it is which is systolic. Certainly, at the outset, there is often no pain in placenta prævia; and, as the case proceeds, active pains—that is, systolic contraction—will often stop the hæmorrhage.

If there is active uterine contraction, even although considerable hæmorrhage attend, and the ccrvix is expanding, the placenta or child being driven down, there is a fair prospect that Nature may carry the labour to a happy termination.

One great differentiating symptom consists in the appearance of the blood discharged. In placenta prævia it is commonly bright, arterial, whereas in accidental hæmorrhage it is commonly black or more venous in appearance; and in the accidental form also there is often a serous, watery oozing, due to the squeezing out of the serum from the retained coagula. The seat and character of the pain are also different. In placenta prævia there may be little pain, and what there is mostly low down in the uterus, whilst in accidental hæmorrhage the pain is almost always great; its seat is at the fundal or the equatorial zones, and in this scat of pain there is felt an irregular prominence on the surface of the uterus.

The only conclusive sign is feeling the placenta. Hæmor-rhage alone is fallacious; it may be due to other causes.

Some cases present great difficulty in diagnosis. The central cases in which the os internum is quite covered by placenta may be recognised by feeling the quaggy mass of placenta interposed between the finger and the fœtus. In cases of lateral placenta, in which a flap or edge of placenta grows down to the os internum on one side, this edge may occasionally be felt merging into the sac of the liquor amnii. But in another class of cases, which is more numerous, in which the placenta, although intruding within the lower zone, does not come within casy reach of the finger, the diagnosis must be mainly conjectural. Nothing is felt but the bag of membranes, and through it perhaps the fœtus. The reality of these cases is established after delivery of the placenta by

observing the situation of the rent in the membranes. If this is found within two or three inches of the margin of the placenta, we have distinct evidence that this margin dipped into the lower zone. This is often coufirmed by the appearance of the intrudiug lots of placenta near the rent. It is often thinner from compression and commonly filled with extravasated blood.

It is often repeated that partial placenta prævia is much less formidable than the placenta centralis. This may be so in some cases; but we are sure that no rule of prognosis or treatment can safely be based upon this assumption. Collins says, in the grandest and most trustworthy of all collections of clinical records: 'I have seen the hæmorrhage as profuse when there was merely a portion of the edge detached as where the great bulk was separated.' Our own experience entirely confirms this statement.

The prognosis as concerns the mother applies to three principal questions: 1. What is the immediate danger to the woman? 2. What is the remote or ultimate danger? 3. Will the case go on at once to the completion of delivery, or will the hæmorrhage subside?

- 1. The immediate danger to life from loss of blood and shock is serious, if the hæmorrhage be profuse, if the cervix remain unexpanded, and if contraction of the uterus and delivery be not secured within a short time. Whenever, then, the loss is rapid and great, telling upon the pulse, the indicatiou is strong to abandon at once the prospect of postpouing labour, and to proceed to accelerate delivery.
- 2. The remote dangers, supposing immediate sinking from hæmorrhage is averted, arise from anæmia more or less directly. The secondary effects of hæmorrhage are: malnutrition; nervous disorders; the local injury to the cervix uteri during labour; the contusion, laceration, dispose to secondary hæmorrhage, to inflammation, and blood-infection from the necrosis of tissue about the mouths of the utero-placental vessels; absorption is enormously increased in activity after hæmorrhage; phlegmasia dolens is not uncommon, and is sometimes of very severe type, being complicated with more than the ordinary degree of blood-infection; all the other forms of puerperal fever are more common after placenta prævia; and, lastly, there

is the prospect of imperfect involution of the uterus, chronic metritis, perimetritis, and parametritis.

The implantation of the placenta upon the lower segment of the uterus involves an enormous increase of vascularity of the part, and this, added to the imperfect development attained when labour comes on prematurely, renders the dilatation of the cervix especially difficult and dangerous. The crushing, bruising, even laceration of the cervix, common to some extent even in ordinary labours, are much more to be dreaded in placenta prævia. Hæmorrhage from laceration is not the only danger. One, a little more remote but scarcely less formidable, is that of inflammation, of pyæmia, or septicæmia. Some of the worst cases of puerperal fever we have seen were the direct consequence of the injury the highly vascular tissues of the cervix underwent from forcible delivery for placenta prævia.

Robert Lee records 6 cases of phlebitis out of 64 cases of placenta prævia.

In 1864 Robert Barnes reviewed his experience of the terminations in 69 cases. The deaths were 6, i.e. 9 nearly. This proportion is much smaller than that usually given in statistical tables. But upon this it is idle to dwell, for general statistical tables drawn from miscellaneous sources are utterly untrustworthy in this matter. Of the six cases, one died three weeks after labour, of pyæmia; one died in a few days from pyæmia following forced delivery, performed by a surgeon who prided himself on his promptitude in the treatment of these cases; two were moribund from hæmorrhage when first seen; one died of exhaustion (she had had eleven children); one died of puerperal fever aggravated by brutal treatment from her husband. We have not been able to search our subsequent records. But we believe the results are not very different.

We feel very confident that if we could always see these cases at the earliest stage of hæmorrhage, and if they were treated on the principles we have laid down, the mortality would be brought very much below anything hitherto known. In the cases above referred to there was a series of 29 successful cases uninterrupted by a single death. In 1884, we have been summoned to 5 cases after hæmorrhage had set in.

All were treated after the method we have laid down. All the mothers and 4 children recovered.

3. Will the case go on to delivery? If the hæmorrhage is moderate, if the os does not dilate, if there is little or no sign of uterine action, there is the probability of the utero-placental relations being so little disturbed that the pregnancy may go on, at least until the succeeding menstrual epoch. But this question is often practically settled by the physician, who, governed by his estimate of the strength of the patient, the stage of the gestation, and the urgency, absolute and relative, of the symptoms, may resolve to accelerate the labour. If the pregnancy have advanced beyond the seventh month, it will, as a general rule, be wise to proceed to deliver. The next hæmorrhage may be fatal; we cannot foretell the time or the extent of its occurrence; and when it breaks out, all, perhaps, that we shall have the opportunity of doing will be to regret that we did not act when we had the chance.

The prognosis as to the child. This will depend very much upon the conduct of the case.

In the event of the flooding and labour coming on before the seventh month, of course the prospect of the child being viable is small. The risk is also much above the average of ordinary labours, even when it takes place after the seventh month. The flooding may be attended with so much detachment of placenta that the supply may be cut off from the fœtus. Again, the imperfect development of the uterus may so retard or disorder the labour that the child may perish before it can be born. Under any method of treatment formerly pursued, the risk was so great that Simpson and Churchill expressed the opinion that the hope of saving the child ought scarcely to influence the treatment. In this view we cannot concur; we are convinced that a judicious application of the principles we have laid down will result not alone in greater safety to the mother, but also in greater safety to the child. It is true that in many cases the child is dead before there is any opportunity for treatment. The child dies from asphyxia, the result of the mother's loss of blood. This blood, which is the means of aëration of the child's blood, comes in too small quantity and too much impaired in quality to effect the necessary change. Frequently, too, the child is, as we have seen, premature, or it

presents unfavourably; frequently the cord is prolapsed, and then the child has to run the gauntlet of artificial modes of delivery. Exposed to these perils, it is not surprising that the child will often perish. But still the broad fact remains that a considerable proportion of children are born alive. It is certain that some of the sources of peril to the child may be lessened or averted. Out of 62 cases of placenta pravia which we noted in reference to this point, 23 children were born alive; and all the cases had been treated under favourable circumstances or in the most judicious manner.

We indulge the hope that a better result than this may be obtained if the proper principles are applied, starting from the onset of the flooding. The total artificial detachment of the placenta before the birth of the child is almost necessarily fatal to it. The precipitate forcible delivery is scarcely less hazardous to the child, and seriously imperils the mother. We are persuaded that the old method of treatment has killed more women and children than the discase.

The Treatment.

The treatment must vary according to the nature of the case; and cases of placenta prævia vary greatly. The course to be adopted will depend somewhat upon whether the presentation is central or lateral. But we think a more practical division is into--(A) cases, partial or complete, in which there is active contractile power in the uterus, with spontaneous dilatation; (B) cases in which the contractile power of the uterus is absent, with or without dilatation.

Before describing the principles and method of treating which we have worked out from theory deduced from observation, and crucially tested by clinical experience, it is useful to point out the methods commonly in vogue before the publication of Robert Barnes's Lumleian Lectures.

These methods flowed logically enough from the theories which successively prevailed. Thus—

1. The 'unavoidable hæmorrhage' theory, simple and absolute, dictated, as we have seen, immediate delivery, the 'accouchement forcé.' We have pointed out the fallacies of this theory, and the dangers attending the practice it dictated.

What does the 'accouchement force' mean? Literally and practically, it means violent delivery at all risk. The hand was forced through the cervix, dilated or not dilated; if not dilated, at the almost certain cost of severe injury to the uterus. This forcible entry accomplished, the child was then seized, turned, and extracted as promptly as possible. Its chance of survival was small, unless the cervix was so far dilated as to admit of easy and rapid delivery.

Spiegelberg proposed bilateral incision of the cervix, if it did not dilate. The proceeding is unnecessary and highly dangerous. Cutting the intensely vascular structure must

expose to hæmorrhage.

In some cases of central placenta it was advised to perforate the placenta and to deliver through the hole thus made. This method has been strongly—upon the whole, justly—condemned. But we have seen a few cases in which the placenta was so extensively diffused over the greater part of the uterus that there could have been no possible way of reaching a margin without passing the hand high up to the fundus. Concurring in the condemnation, we can imagine a case in which the practice of perforating the placenta might be excused.

2. The theory of Radford and Simpson, which, assuming that the hæmorrhage came from the placenta, dictated the rule to detach the placenta wholly as early as possible. Some of the fallacies of this theory have been pointed out. The practice based upon it is open to serious objections. In the first place it assumes that the probability of saving the child is so insignificant that it need not be considered. But we have seen that, under judicious management, a large proportion of children are saved. The operation consists in passing the hand, if necessary, into the vagina, then to pass two fingers through the cervix uteri, and with them to detach the placenta. This done, it was contended that Art had imitated Nature in those cases in which the placenta was cast spontaneously. The fallacy of this comparison and deduction has been already exposed. But Robert Barnes urged a fatal objection against this proceeding, showing that it was all but impracticable. In by far the greater number of cases the placenta extends higher than the equator of the uterus, sometimes even reaching the fundus. The fingers are not long enough to reach half-way towards the further margin

of the placenta. The diameter of the placenta is rarely less than nine or ten inches; the fingers can hardly reach three or four inches. In the greater number of cases, therefore, in which the directions prescribed have been followed, the placenta has not been wholly detached; and the result, when successful, cannot be attributed to an operation which was not performed. is further proved by the history of some of the cases narrated as examples of this practice. The child was born alive. It is hardly consistent with our knowledge of the conditions upon which the child's life depends to suppose that the child will survive if the whole placenta be detached, unless the birth follow the detachment very quickly. And this condition under the postulates of the hypothesis is wanting. This objection, so obvious when simply stated, was not suspected by Professor Simpson or his disciples until it was formally enunciated by Robert Barnes.

The entire detachment of the placenta has been urged on the ground that it can be executed at a stage when the dilatation of the cervix is insufficient to admit of turning. But if it cannot be executed without passing the hand through the undilated cervix, in what respect is the operation less severe than that of delivery by turning? It is reasonable to conclude that, since the forcible entry has been effected, the seizure and extraction of the child, as well as the detachment of the placenta, had better, in order to give the child a chance, be completed at the same time. This granted, the special character of the proceeding vanishes; it is even more severe than turning, which does not require the hand to be passed through the cervix.

In conclusion, we see that the surgeon endeavouring to practise complete detachment of the placenta by help of two fingers passed through the os uteri unconsciously, but almost ex necessitate rei, fails in what he tries to do; he unwittingly does very nearly what he ought to do. The hæmorrhage stops; he sees in his success a proof of the truth of the theory that total detachment of the placenta is the security against hæmorrhage. But he has not wholly detached the placenta; he has unconsciously given proof of the truth of a very different theory, namely, that the hæmorrhage ceases when that part of the placenta which had grown within the lower polar zone has been detached.

Cohen's method.—Cohen of Hamburg, regarding the central placenta as being the condition of chief danger, advises to detach that smaller flap of placenta which passes over the os internum to the opposite side from the main body, thus reducing a central to a lateral placenta. This proceeding, fundamentally distinct in its theoretical argument and in its intrinsic nature, has been by some writers confounded with Barnes's method, to be presently described.

Barnes's method.—The preceding discussion establishes the fundamental facts that hemorrhage can only be securely arrested by the contraction of the uterus, constringing the vessels, and favouring plugging of the vessels by thrombosis. All rational treatment must be based upon these facts. obtain contraction is, therefore, the end to be sought. Although the powers of the system may still be good, the uterus will not always act well, especially when the labour is premature, whilst it is fully distended. To evoke contractile energy it is often enough to puncture the membranes. This done, some liquor amnii runs off; the uterus, collapsing, is excited to contract, and, being diminished in bulk, it acts at advantage. Labour being active, the cervix expands promptly, the placenta gets more quickly detached from the lower polar zone, the bared uterine vessels get closed by the retracting tissue and by the pressure of the advancing fœtus. The hæmorrhage ceases spontaneously.

The successive steps to be adopted may be formulated as follows:—

1. The puncture of the membranes is the first thing to be done in all cases of flooding before labour sufficient to cause anxiety. It is the most generally efficacious remedy, and it can always be applied. It is sometimes sufficient in itself; it does not materially interfere with the resort to further steps. The mode of executing it is: the patient lying on her left side, a finger is passed up into the os uteri, guiding a stilet, quill-pen, or a porcupine's quill to the membranes, whilst the uterus is supported by external pressure. This plan is especially useful in partial presentations; but even in central cases, if the cervix is not dilated, it may be resorted to by perforating the placenta. In these cases a long aspirator needle would be preferable.

Before puncturing the membranes pass the catheter. A full bladder is pretty sure to disturb or divert the natural eontraetile action of the uterus.

- 2. At the same time apply a firm binder over the uterus. This further promotes contraction, and, by propelling the ehild towards the os uteri, it accelerates the expansion of the os and moderates the hæmorrhage.
- 3. If the hæmorrhage continue, especially if the patient show signs of exhaustion, the os uteri being undilated, the pluq may be tried. Leroux, Dubois, Chailly, and many other authorities extol the plug. What has usually been understood as plugging eonsists in ramming soft substances into the vagina. Vaginal plugging: The things used are silk handkerchiefs, tow, lint, bandages, and Braun's colpeurynter. This last is an elastic bag, which may be distended with air or water. As its name implies, it is a vaginal plug. Vaginal plugs are treaeherous aids, requiring the most vigilant watching. The plug, introduced with so much pain to the patient, soou becomes compressed, blood runs past it or accumulates above or around it, and the tide of life ebbs away uususpected. Never leave the patient trusting to vaginal plugs. Feel her pulse frequently, watch her face closely, examine to see if any blood or tinged serum is oozing externally. Remove the plug iu an hour at furthest, and feel if the os uteri is dilating. If it be dilating and the hæmorrhage have stopped, you may trust Nature a little further, watching closely. The labour may now go on spontaneously, perhaps issuing in the birth of a living child.

But the true way of plugging is to insert sponge or laminaria-teuts into the cervix uteri. This is the part that needs to be dilated. The teuts command this effect by direct stretching, and by exciting diastaltic action.

Whenever plugging is resorted to, use especial care in watching the state of the bladder. Partly by direct pressure upon the urethra, and partly by diverted or 'metastatic' nervous energy, plugging is apt to eause retention of urine.

4. Expectancy has its limits. This is determined by the continuance of the hæmorrhage and the couditiou of the patient. The question of resort to the accouchement force presents itself perhaps imperiously to the mind. But there are two means of accomplishing the end in view without

violence, with more certainty, and with more safety to the patient and her child. The uterus must be placed in a condition to contract. The essential steps towards this end are—first, the free dilatation of the cervix; secondly, the completion of the labour.

The first difficulty is to effect the dilatation of the cervix. Under any process this must take a little time. Can anything be done in the meantime to moderate the bleeding? Something very effectual may be done. Separate all the placenta which adheres within the lower zone. We shall thus get over the stage of danger more quickly. We remove an obstacle to the dilatation of the cervix, for the adherent placenta acts as a mechanical hindrance to the retraction of the lower segment of the uterus; we lessen the risk of laceration of the placenta, an accident very likely to happen in the ordinary course and under turning, and which, by rupturing the feetal vessels, adds to the peril of the child.

The operation of detaching the placenta from its adhesion to the lower polar zone is as follows :-- Pass one or two fingers as far as they will go through the os uteri, the hand being passed into the vagina if necessary; feeling the placenta, insinuate the finger between it and the uterine wall, sweep the finger round in a circle so as to separate the placenta as far as the finger will reach. If you feel the edge of the placenta where the membranes begin, tear open the membranes freely, especially if these have not been previously ruptured; ascertain if you can what is the presentation of the child before withdrawing your hand. Commonly some amount of retraction of the lower zone and opening of the cervix takes place after this operation, and often the hamorrhage ceases. Time has been gained. The patient has the precious opportunity of rallying from the shock of previous hæmorrhage and of gathering up strength for further proceedings.

If, the cervix being now liberated, under the pressure of a firm binder, ergot, or stimulants, utcrine action returns so as to drive down the head, it is pretty certain there will be no more hamorrhage. The head acts as a plug from above, compressing the bare surface of the uterus. You may leave Nature to expand the cervix and to complete the delivery. The labour,

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freed from the placental complication, is resolved into natural labour.

5. If, on the other hand, the uterus continue inert, the hæmorrhage may not stop, and we must proceed to the next step, the artificial dilatation of the cervix. This is accomplished by the use of Barnes's hydrostatic dilators. Insert the largest size that will pass through the cervix; distend with water gently and gradually, watching by the finger the effect of the eccentric strain upon the ring of the os externum. When the bag is fully distended, keep it in situ for half an hour, or an hour if necessary. During this time the hæmorrhage is commonly suspended; probably the intra-uterine portion of the bag presses upon the mouths of the bared vessels; certainly retraction or shortening of the lower segment of the uterus goes on, which is the direct means of closing these vessels; and under the combined effect of pressure from below by the dilator and from above by the binder, the contents of the uterus are kept in close contact with its inner surface, thus maintaining pressure on the vessels of the cervix, and stimulating the whole organ to contract. Legroux, guided by the observation that hæmorrhage occurs during uterine diastole, puts the patient in the vertical position during uterine relaxation, so as to keep up the pressure of the contents of the uterus upon the cervix. He relates a case in which this practice perfectly succeeded. But it is obvious that the upright posture adds to the danger of syncope. The bags accomplish the purpose better and more safely. When the cervix is freely open the bag may be withdrawn.

Again we may pause and observe if Nature is able to carry on the work. If contraction persist, if the head present, the labour is now essentially normal, and may be allowed to go on without interference. But we must watch closely.

6. If contraction is inefficient, if hæmorrhage goes on, if another part than the head present, we must carry our help further. We must do what Nature cannot do: we must deliver. If the head present, it is generally best to put on the forceps; then, pulling gently in the axis of uterus and pelvis, keep the head upon the os uteri for a while, until it is felt that the expansion is sufficient to permit it to pass without undue force.

If the shoulder or breech present, we deliver by seizing the nearest leg and extracting. This can almost always be done without passing the hand into the uterus. Braxton Hicks's bi-manual operation here finds one of its most useful applications. It avoids the danger of forcing the hand through an imperfectly developed, imperfectly expanded cervix, and abnormally vascular structure. Having seized a leg, it must be drawn down gently, so as to bring the half-breech into the cervix. Axial traction must be so regulated as to bring the trunk through with the least amount of force. Whilst delivery is going on, the hæmorrhage is generally arrested. Rapid extraction involves a certain amount of violence and shock. Gentle extraction, giving the cervix time to dilate gradually, avoids this evil.

7. As soon as the child is born, readjust the pressure upon the uterus; and if there is no hæmorrhage allow three or four minutes for the system to rally, before attempting to remove the placenta. If hæmorrhage occur, and the placenta does not pass on fair compression of the uterus and traction on the cord, the hand must be passed into the uterus to detach it. The portion growing to the equatorial zone is not always readily cast. Examine the placenta carefully on its uterine surface to see if it is entire.

In every labour, the cervix, having to suffer great distension and contusion under the passage of the child, and possessing less contractile elements in its structure, is liable to paralysis for a time. This condition is more likely to occur in labour with placenta prævia, and it is doubly dangerous because the cervix is so near the placental seat. Here is another reason for sparing the cervix to the utmost.

The history and management of hæmorrhage after the completion of labour, complicated with placenta prævia, merge into the conditions of post-partum hæmorrhage generally; the special point to remember being that the after-hæmorrhages of placenta prævia are likely to be even more urgent, and thus to require more vigilance and more resolute treatment.

The chief facts in relation to placenta prævia may be

The chief facts in relation to placenta pravia may be summed up in the following series of physiological and pathological propositions. Abounding clinical observations recorded by ourselves and others attest their truth.

A. Series of Physiological Propositions.

- 1. The hæmorrhage comes mainly from the bared uterine surface, and is arterial.
- 2. In the progress of many labours with placenta prævia, there is a period or stage when the flooding becomes spontaneously arrested.
- 3. This haemostatic process does not depend upon total detachment of the placenta, nor upon death of the child, nor upon syncope of the mother, nor upon pressure upon the lower segment of the uterus bared of placenta, although one or more of these conditions may favour it.
- 4. The one constant condition of this physiological arrest of the flooding is contraction of the uterus, active or tonic.
- 5. This physiological arrest of flooding is neither permanent nor secure until the whole of that portion of the placenta which had adhered within the lower zone is detached, this being the portion which is liable to be separated during the opening of the lower segment of the uterus to the extent necessary to give passage to the child. The limit of dangerous placental attachment corresponds to the equator of the child's head. Below this, the circle so indicated, the lower segment must dilate; above this circle the placental attachment is normal, and need not expand. This physiological boundary line is identical with Bandl's ring.
- 6. When this stage of detachment has been reached, there is no physiological reason why any further detachment or flooding should take place until after the expulsion of the child, when, and not till then, the remainder of the placenta which adheres to the middle and fundal zones of the uterus is cast off, as in normal labour.
- 7. Adhesion of the placenta over the os uteri internum impedes the regular dilatation of the part; and, consequently, whilst such adhesion lasts the orderly course of labour is hindered.
- 8. Injury and inflammation of the uterine structures, particularly of the eervix, are especially likely to supervene upon delivery in placenta prævia. One of the purposes intended by Nature in fixing the seat of the placenta in the fundal and

equatorial zones is the prescriation of the parts, rendered highly vascular by connection with the placenta, from the distension, pressure, and contusion attending the passage of the child.

B. Series of Therapeutical Propositions.

- 1. The greatest amount of flooding frequently takes place at the commencement of labour, and frequently even before there is any clear indication of labour. The cervix is always, from its being near the seat of the placental attachment, highly vascular, and is frequently at this stage very rigid. Any attempts to force the hand through this structure at this stage, to detach the whole placenta or to deliver, must be made at the risk of injuring the womb. The dragging the child through the cervix when in this condition, even when it has not been necessary to pass the hand into the uterus, is a proceeding affording slender chance of life to the child, and fraught with danger to the mother.
- 2. The entire detachment of the placenta is not necessary, and is not to be depended upon, to ensure the arrest of the hæmorrhage.
- 3. Since the dilatation of the cervical portion of the womb must take place in order to give passage to the child, and since, during the earlier stages of this necessary dilatation, hæmorrhage is liable to occur, it is desirable to expedite this stage of labour as much as possible.
- 4. In cases where labour appears imminent, with considerable hemorrhage, whilst the os internum uteri is still closed, the arrest of the flooding and the expansion of the os may be promoted by plugging the vagina, especially the cervix, and by the use of ergot.
- 5. Since a cross-presentation or other unfavourable position of the child at the os internum is apt to impede or destroy the regular contractions of the uterus, which are necessary to arrest the flooding, it is mostly desirable to deliver as soon as the condition of the os uteri will permit.
- 6. In some cases the simple use of means to excite contraction of the uterus, such as ergot, rupturing the membranes, or the employment of galvanism, may suffice to arrest the hemorrhage.

- 7. In some cases in which it is observed that the os uteri has moderately expanded—namely, to a diameter of 1.25 in., or 4 cm.—the placenta being felt to be detached from the lower zone, and the hæmorrhage having ceased, it is not necessary to interfere with the course of the labour, now become normal.
- 8. At the critical period, when the total detachment of the placenta or forcible delivery is dangerous or impracticable, the introduction of the index finger through the os, and the artificial separation of that portion of the placenta which lies within the lower zone of the uterus, is a practicable and safe operation.
- 9. The artificial detachment of that portion of the placenta which adheres within the lower zone will at once liberate the os internum from those attachments which impede its equable dilatation, and, by facilitating the regular contraction of this segment of the uterus, favour the arrest of hæmorrhage, and convert a labour complicated with placenta prævia into a natural labour.
- 10. The immature uterus, partly paralysed by loss of blood, cannot always be trusted to assume the vigorous action necessary to effect delivery; it is, therefore, often desirable to aid by dilating the cervix artificially; this can be done safely and quickly by the caoutchouc water-dilators.
- 11. Sufficient dilatation being attained, delivery may, if necessary, be accelerated by forceps, turning, or craniotomy, according to the special indications afforded by the condition of the child.

Post-Partum Hæmorrhages.

It is convenient to include under the title post-partum hamorrhage all the hamorrhages which occur from the birth of the child, and during the succeeding twenty-four hours. These latter may be further distinguished as primary post-partum hamorrhages.

But hæmorrhages may occur after this period and at any time for a month or more. These may be distinguished as 'puerperal hæmorrhages,' or as secondary post-partum hæmorrhages.

It is difficult to draw a strict physiological line between

these two. But an arbitrary line thus drawn has a clinical value. Theoretically, the distinction may be stated thus:—
That is primary post-partum hæmorrhage which takes place whilst the uterus, recently disburdened, still retains its muscular fibre unaltered. At the end of twenty-four hours, or nearly, the involution-process has generally begun; from this time is the period of secondary hæmorrhages.

In practice, we have to prevent or to treat (a) hæmorrhages whilst the placenta is retained; (b) hæmorrhages persisting or breaking out after the placenta is removed. These two constitute primary hæmorrhage; and primary hæmorrhages may be usefully subdivided into (1) immediate, and (2) those which occur later, from the uterus relaxing again after apparent firm contraction had been attained. These may be called paulo-post-partum hæmorrhages. (c) Hæmorrhages which persist or break out after twenty-four hours from childbirth. These constitute secondary hæmorrhages.

- (a) The hæmorrhages which break out before the removal of the placenta have been discussed in the chapter on the management of the after-birth stage of labour (see p. 25).
- (b) Although in most cases flooding will cease when the after-birth has come away, still it not seldom happens that flooding will persist or break out afterwards. Many of the causes which lead to hæmorrhage during the after-birth period may continue to act after the placenta is removed. Almost all these causes have for one important effect to impair the contractile energy of the uterus.

The causes of primary post-partum hæmorrhage may be divided into two classes:—(1) those antecedent to the labour; (2) those which arise during and after the labour.

The first order of causes often lie deep in constitutional peculiarities. Foremost amongst these is the mysterious hemorrhagic diathesis. Some women are by nature 'bleeders. All through pregnancy and labour these women are likely to be the subjects of hemorrhage. Under the peculiar conditions of the blood, of the vascular apparatus, and other special conditions, the hemorrhagic diathesis is pretty sure to assert itself.

Other remote antecedent or predisposing causes have been described in the chapters on the physiology and pathology of gestation (see Vol. I.); we may recall some of the principal

causes. Albuminuria has been shown by Blot and Chantreuil to be a potent predisposing cause. The correlated condition of the blood is, in fact, constantly favouring extravasation at the weak points of the utero-placental vascular system. Then there are spamemia, leucocythemia, hepatic sluggishness or obstruction, some diseases of the heart and lungs. Cullen insisted forcibly on the evil influences of alcoholism. 'All our drunkards,' he said, 'have their blood more fluid than natural, and are liable to hæmorrhages.' Again, delicately-nurtured women, who have cultivated the emotional element at the expense of physical development, are especially prone to disordered labour, to hæmorrhage, and the other accidents of childbirth. In such women there is a want of due relation between nervous and muscular power.

2. The Immediate Causes, or those arising during Labour.

The main security against hamorrhage lies in the orderly course of labour. If the labour be so conducted as not to disturb the due sequence and correlation of the acts which govern the labour, the risk of hæmorrhage will be small. But, true as this aphorism is, we are not hastily to conclude that the preservation of this orderly sequence is always in the power of the physician. In the case of healthy women, no disturbing cause intervening, the labour proceeds in due order, if only the physician will abstain from interference. But in not a few cases of healthy women, as in many who are not healthy, adverse conditions have existed before, or arise during the labour, which there has been no opportunity to obviate. physician has to deal with them as he finds them, doing his best to remove them or to overcome them. Under the combined action of these adverse conditions and of the treatment required, the normal sequence and correlation of the parturient forces is unavoidably disordered; hence hæmorrhage.

Amongst the most efficient causes of this class are:—Anæsthesia, induced by chloroform or ether; emotion; lingering labour, especially when artificial intervention is required, as from malposition or malproportion; hæmorrhage during the first and second stages; premature rupture of the membranes; injudicious voluntary efforts, as forcible bearing-down whilst

holding on a towel tied to the bed-post. Voluntary efforts in aid of labour should wait upon the involuntary reflex effort. If made independently, they wear out the nervous power and impede rather than help the reflex work. Protracted labours, labours with plural births in which the placental area is doubled, whilst the muscular power is weakened, are especially apt to entail hæmorrhage. Undue haste in extracting the placenta, retention of urine, retroflexion of the uterus, fibroid tumonrs or polypus strongly dispose to hæmorrhage.

Hæmorrhage after the removal of the placenta may proceed from the following sources:—(1) from the bared placental site; (2) from laceration of the cervix uteri; (3) from injury to

the vagina or vulva, as from thrombus or laceration.

The treatment of hæmorrhage—prophylactic, arrestive, and restorative—must be based upon a rational study of the phenomena which precede and accompany it—that is, upon the physiological history of pregnancy and labour.

What are the means which Nature employs to prevent and to arrest hemorrhage?

1. The first is active contraction of the muscular wall of the uterus. The contracting muscular fibres surrounding the arterial and venous canals close them tightly in proportion to the vigour of the eontraction. To obtain this contraction is the great aim of the obstetrist. To many it is the only aim, being ignorant of or distrustful of the value of any other. In this they fall below the level of physiological law, which has yet other resources.

At first this contraction is rhythmical, partly peristaltic and partly reflex. But presently, active contraction settles into passive or tonic contraction, by which the volume of the uterus is permanently reduced. This resembles elastic contraction, and has been likened by Leroux to a spring (ressort). When this tonic contraction has been established, the patient is secure against a return of hæmorrhage—unless, indeed, we except the 'peculiar form of hæmorrhage' described by Gooch. This keen observer, admitting that 'contraction prevents hæmorrhage by occasioning a sufficient closure of the vessels to resist the ordinary force of the circulation,' supposes that if the force of the circulation be extraordinarily great, it would be able to overcome the ordinary closure of the vessels. He gives a

striking ease in illustration. The patient showed marked fullness—or, as we now express it, high tension of the vessels—before labour.

2. The uterine arteries have a certain retractile property. Shrinking inwards when severed, their mouths become narrowed, and the formation of thrombi is favoured. Marey also showed that the arteries shrink generally, their ealibre lessening. Hales, first by experiments, showed that abundant hæmorrhage lowers arterial tension; that on reinjecting blood tension rose again. But it also depends upon the duration of the subtraction or of the injection of blood, for the arterial system, if distended suddenly, quickly throws into the veins the excess of blood received. Inversely, if the arteries have sustained a rapid subtraction of blood, they quickly repair the loss by ealling upon the venous system.

Thus there is accommodation under hæmorrhage. If the vessels fill, accommodation is by relaxation of the vessels; if there is hæmorrhage, there is accommodation by contraction.

3. When the nutritive developmental attraction of blood to the uterus is suddenly eut short by the separation of the child and placenta, there ensues an equally sudden diversion or raptus of the blood-current away from the uterus into the general or systemic circulation. In this diversion lies an effective security against hæmorrhage. An illustration of this is seen in the counterpart or correlative diversion of blood from the umbilical arteries of the child when the placental connection with the uterus is cut off. The two circulations, maternal and fætal, hitherto irresistibly drawn to meet at one focus, the one to bring life-elements, the other to seek them, at once turn aside into different routes as soon as the life of the child is secured by independent means. Thus, blood no longer running into the uterine arteries, stagnation follows, and hence another provision for plugging the vessels by clotting.

Robert Ferguson dwelt much upon coagulation as a security. 'It appears,' he says, 'to be the sole means of safety in those cases of intense flooding in which the utcrus flaps about the hand like a wet towel. Incapable of contraction for hours, yet ceasing to coze out a drop of blood, there is nothing apparently between life and death but a few soft coagula plugging up the sinuses.'

- 4. This diversion of blood from the utcrus, and clotting of blood in the uterine vessels, is further promoted by the rapid lowering of the nervous and vascular tension which follows delivery. The heart beats less forcibly; the impetus of blood in the aorta is diminished.
- 5. A special hæmostatic property is found in the blood itself. The ordinary blood of pregnant women contains more fibrine than is found in non-pregnant women; and Andral demonstrated that the proportion of fibrine, and hence the coagulability of the blood, increased with the quantity of blood lost.
- 6. Then another resource Nature still holds in reserve, and that is the temporary lowering, approaching to suspension, of the heart's action under syncope. Under this state coagulation in the uterine vessels is further favoured, so that when the heart resumes its action the vessels are closed. The situation is perilous in the extreme; life trembles in the balance; the slightest shock, further loss of blood, ever so small, may turn the scale against hope.

It is in the careful clinical study of all these conditions, excepting the last, separately and in their solidarity, that we must seek indications for treatment. In a typical labour, all these conditions are factors of one great conservative process. They are indissolubly associated, coming into play simultaneously or nearly so, and if one factor fails, especially contraction, the rest also commonly fail.

The most constant phenomenon in hæmorrhage is loss of contraction of the uterus. This is recognised under the terms atony, inertia, paralysis. Temporary paralysis is the best term. The paralysis is duplex; there is failure of centric nerve-force, so that there is imperfect action of the diastaltic function; there is failure of the uterinc inherent contractility dependent upon its proper ganglionic nervous system.

When the uterus relaxes, after having been contracted, one thing follows. The expansion of the uterine walls opens up the vascular channels in their substance, and thus exerting a suction-force, blood is drawn into them from the arterial system certainly, and probably also from the venous system. When contraction comes, part of this blood may be driven into the systemic vessels, but the greater part is discharged into

the uterus and is lost as hæmorrhage. This process being repeated, the blood is thus, by a scarcely exaggerated figure of speech, pumped out of the body. Often, again, emotion, the dread of flooding, taking off the inhibitive action, determines blood to the uterus and adds force to the local hæmorrhagic factors.

The immediate general effects of bleeding are:—1. To disturb the balance between the circulating and respiratory systems. 2. To promote the influx of fluids from all parts of the body into the venous system. 3. To promote the tendency to the separation of fibrine. 4. Syncope. 5. Convulsion of the muscles from the removal of nervous control, muscular irritability being retained. 6. Fall of animal temperature.

The symptoms, diagnosis, and prognosis of hæmorrhage from the uterus.—The first warning often is the complaint of the patient that she feels blood flowing from her. This should never be disregarded. Examine the parts and the linen immediately. You will often see a thin stream of florid blood trickling down. You feel for the uterus, and find that it rises above the pubes, perhaps above the umbilicus—that it is flaccid, or presents irregular, hard prominences which shift their position under your grasp. On compressing the fundus firmly, blood and clots may be forced out of the vagina. If the uterus is not brought to contract by the usual means, you pass your hand into the cavity, and feel that it is full of blood partly clotted; you feel the enlarged cavity; you feel the flabby walls. When the inertia is complete, it is sometimes difficult, by external manipulation, to make out the uterus at all. You miss the hard globe, and this negative sign is all. When the uterus has reached its full measure of distension, spasmodic contraction is sometimes excited, and a furious rush of blood is poured forth. Alternate contractions and relaxations, pain attending, and tenderness on grasping are certain signs of hæmorrhage from atony. Blood may issue in a considerable stream, or by gushes mixed with loose clots. Or it may simply ooze in a thin stream; in this case the discharge is often watery. A watery discharge tinged with blood, if occurring immediately after the expulsion of the placenta, may sometimes be liquor amnii; but if occurring at other times, and in connection with signs of general depression, it indicates internal hemorrhage, with retention of elot, the serous element being squeezed out and flowing externally. These are the *local signs*. The *general signs* are scarcely less marked. Bleeding

The general signs are scarcely less marked. Bleeding often goes on insidiously, the woman not complaining. But this calm may be illusory. In extreme cases a degree of shock, of eollapse, is conspicuous; the face is pale, white, waxy, and cold; the whole surface is cold, the pulse is frequent, feeble, thready, sometimes not to be felt. Hales established that the pulse became more frequent by hæmorrhage. Marey showed that at the same time there was feeble tension (see fig. 45). The sudden penetration of blood in the arteries swells the fulness of the pulsations and causes dicrotism. This is the more marked in proportion to the rapidity of the loss.



Fig. 45. Sphygmogram of a case of post-partum hæmorrhage. (Fancourt Barnes.)

If hæmorrhage is very abundant, a contraction of vessels is produced which restores tension, and causes disappearance of the increase of fulness of pulse, more especially since the radial, like all the arteries, undergoes a diminution of calibre, which by itself would render the pulsations weaker. It is this kind of shrinking of the vessels which J. Hunter observed in animals bled to death, which led him to the discovery of the contractility of the arteries.

There is an indescribable sense of oppression in the chest. The woman calls out for air, will have the windows open, insists upon sitting up, sometimes would even get out of bed; the respirations rise to 30, 36, or even to 40 in the minute, they are laborious; she tosses her arms about, says 'she is sinking through the bed;' is more or less delirious; her perception of external objects is often dulled, or her appreciation of them is distorted; partial blindness, double vision, sometimes complete amaurosis set in, the pupils dilate, the iris seems paralysed; she ceases at times to recognise the people about her; she complains of intense headache, noises in the ears, sometimes is

deaf; she can hardly swallow, unless the fluid be poured into the back of the mouth. So great is the loss of nerve-power that every organ seems paralysed. Brandy, beef-tea, medicines lie inert in the stomach, until rejected by vomiting. The uterus refuses to act under any stimulant; perhaps the sphincters relax, fæces and urine being voided. The woman rejects help; by word or sign entreats to be let alone; she would willingly die undisturbed. From this state, desperate as it seems, she may recover. If the bleeding stop for awhile, slowly there is gathered up a little nerve-force; life that seemed ready to flit, holds its seat, feebly, it is true, and if no fresh loss or shock occurs, she may rally.

But if these signs are followed by marked collapse, contracting features, short gasps, sighing or sobbing inspirations, which indicate that the chest-walls are unable to expand and make but an imperfect attempt to take in air, then quickly collapse; and if convulsive movements occur, the case is indeed desperate. Restorative means, which will be described, offer the only prospect.

The favourable signs are returning warmth and moisture of the skin, disposition to swallow, steady pulsation at the wrist, contraction of the uterus, a more tranquil respiration, a feeling of hopefulness and courage, a clearer perception, a more accurate and steady judgment.

Now we have to interpret the physiological significance of these symptoms, with the view to draw from them principles of treatment.

Under analysis and synthesis these symptoms may be summed up in the following classification:—

We can hardly form a useful judgment of the extent to which the hæmorrhage has affected the patient from noting the quantity of blood lost. It is not easy to measure or to estimate this loss; and the effect upon the system has no constant relation to the quantity of blood lost. But there are certain physiological data, not difficult to note, which mark with sufficient accuracy the successive stages of danger.

Hamorrhages may be divided into three stages or degrees, marked by the fall of the reflex function. In the first degree, the diastaltic function is maintained in its integrity; but it is disordered in its action. There is, however, ready response to the ordinary irritants. In the second degree there is a sensible loss of reflex activity. The response to ordinary and even to extraordinary irritants is feeble and uncertain. In the third degree, there is suspension or nearly extinction of the diastaltic function. In this degree, vomiting, yawning, rapid, feeble, intermittent, vanishing pulse, syncope, loss of temperature, may be the forerunners of death. Paul Bert says the only constant sign of imminent death is convulsions.

The application to treatment in the first degree.—We look to the diastaltic function to stop bleeding by inducing contraction of the uterus. This appeal is made in three ways: through the brain by giving confidence to the patient, thus enlisting on our side the aid of the emotions; through the spinal or respiratory system, by exciting the peripheral nerves, as by the application of the child to the breast; by cold suddenly applied to the abdomen; by compression of the uterus; by cold and heat applied separately or alternately to the interior of the uterus, as Tyler Smith advised. These mechanical measures are powerfully aided by certain medicines. If we observe that the hemorrhagic pulse indicates over-excitement of the heart, and that uterine colic indicates that the action of the uterus is perverted or disordered, the greatest advantage is drawn from opium, digitalis, and bromide of potassium. Here also ergot is at times of use.

It is, however, generally recognised that the best time to give ergot is near the end of the expulsive stage of labour, that is, in anticipation of hæmorrhage. It is contended that the specific action of ergot works better if given in aid of the natural contractions of the uterus, and that thus permanent contraction is more likely to set in. As a clinical fact, however, it often disappoints, and sometimes it even does harm by disturbing the harmony of the parturient efforts. We believe that the value of ergot is much increased by combining with it digitalis; and quinine, a valuable oxytocic, may also usefully enter into the prescription. The following formula may be adopted: liquid extract of ergot \mathfrak{m} xx.-xxx., tincture of digitalis \mathfrak{m} xx., tincture of quinine \mathfrak{z} j., tincture of cinnamon \mathfrak{z} ss., water \mathfrak{z} ijs. This dose may be repeated.

Turpentine is a valuable hemostatic. It may be injected into the rectum in the proportion of one ounce of turpentine

to five of mucilage or gruel. J.W. Bradley, reported excellent results from turpentine given by mouth. We can bear testimony to its use, but it is difficult to administer it in this way. It might be usefully injected into the uterus.

In severe cases ergotine may be injected subcutaneously.

In the second degree, the difficulties are increased. The diastaltic function is weakened. It must be coaxed, not overridden. Ergot, quinine, digitalis may still be useful. But it cannot be too emphatically declared that ergot is incapable of giving strength to the spinal centre, that it can only stimulate it, just as whip and spur goad the jaded horse. If pushed beyond a moderate degree, ergot then only tends to depress, to exhaust. Hence it is not rare to see its use, in the conditions described, followed by vomiting, spasmodic action of the uterus, and even by sensible depression of the heart. The rule should be: give ergot early after the expulsion of the child, where hæmorrhage is apprehended; repeat it as soon as hæmorrhage declares itself; but if it fails to act promptly, give no more. We must turn to surer means.

Direct compression of the uterus acts in two ways: first, by mechanically closing the vessels; secondly, by exciting diastaltic contraction.

The uterus may be compressed in several ways:

1. By grasping the uterns through the abdominal wall. 2. By pressing it strongly back against the spinal column, the patient lying on her back. This acts also by compressing the aorta. Ploucquet compressed the aorta against the spine. This was adopted by Baudelocque, Chailly, Caseaux, and others. 3. G. Hamilton² advised the following: The fingers of one hand introduced into the vagina are placed under the uterus; then, with the other hand upon the uterus externally, the organ is firmly compressed between the two hands. The cavity is thus closed by the anterior and posterior surfaces being flattened together. It is an excellent plan. 4. Gooch's plan. Gooch passed a hand into the uterus, and applying it to the placental site, compressed the wall between the hand inside and the hand outside. The plan is no doubt effectual, but it is not so good as Hamilton's. The introduction of the hand into the uterus is not free from danger. It has been fatal.

¹ Lancet, 1861.

² Edinburgh Medical Journal, 1861.

Compression of the uterns, skilfully performed, checks bleeding, and gives time to rally strength and for the administration of restorative remedies, as alcohol, ether, ammonia, cinnamon. Thus the diastaltic force may be restored. Cold may help. A lump of ice may be applied to the belly, to the vulva, inside the vagina, or, better still, as Levret did, inside the uterus. But it is essential to know that, in severe cases, cold may be hurtful. Bleeding, we know, reduces the bodytemperature. Under the loss of balance between the respiratory and circulatory systems and the diminished volume of blood, the animal heat is with difficulty maintained. Cold, artificially applied, therefore, adds to the depression. Physiological and clinical observations thus alike urge extreme caution in the use of cold. It is the agent, of all others, most abused. We have seen many cases of metritis and puerperal fever which we could trace to no other cause than the abuse of cold and wet and kneading. Bence Jones and Dickinson 1 found that cold douches lowered the pulse. Breathing cold air has the like effect. Heat raises the pulse.

The rule as to cold then should be like that as to ergot. If it fail to act promptly, give it up. Now, the indication is clear to economise the nervous energy, trying to re-awaken the diastaltic function by *heat*. This is done by applying hot bottles or flannels to the skin, by injecting water at 100° F. to 110° F. into the uterus.

The uterine tube is carried fairly into the uterus, and a current is gently propelled during a minute. Carbolic acid, in the proportion of one per cent., may be usefully added. Besides its antiseptic action I have observed that it exercises some astringent action. A better thing still is probably a solution I in 2,000 of corrosive sublimate. If the hot water fail, it may be useful to alternate with an injection of iced water. During this manœuvre the hand should maintain compression of the uterus. And in combination with this the aorta may be compressed. The patient is on her back. The nterus grasped in both hands, part of one hand presses the aorta against the left side of the spinal column. Kiwisch, Hohl, Boër, object that pure compression of the aorta on Ploucquet's plan is not effective, that the blood goes round by the spermatic arteries, and that the real

good is due to compression of the uterus. It ought certainly not to supersede compression of the uterus.

If the uterus still refuse to contract, things are lapsing into the third degree, in which the diastaltic function is in abeyance. It may return if the hæmorrhage can be stopped for awhile. In the meantime we must appeal to other factors which nature holds in reserve. She may answer to an appeal made to the vis insita, that essential contractility which the uterus preserves for some time independently of the spinal centre. The interior of the uterus may shrink under styptic applications; the mouths of the vessels may be blocked by coagula. We may then gain respite enough to resort to restorative measures, and thus to allow muscular contraction to return.

Of the remedies that now present themselves, the most scientific is Faradisation. The experiments of Radford, Robert Barnes, and Mackenzie, demonstrate that, under this power, the uterus can be made to contract, even when it resists the influence of what may be called the diastaltic remedies. We used it assiduously on many occasions, sometimes succeeding in inducing permanent contraction, sometimes not. Practical objections prevailed with us to give it up. Except in hospital practice the apparatus is not likely to be ready on the emergencies that call for action; for the most part the contractions induced were transitory, ceasing when the circuit was broken, and whilst using it the more valuable compression of the hand had to be abandoned. Private reports inform us, however, that it acts satisfactorily. Dr. Kilner adduced strong evidence in its favour before the Obstetrical Society, 1884. We would, therefore, encourage further trials.

Failing, then, to induce muscular contraction of the uterus, we are driven to choose agents that corrugate the inner wall of the uterus, and thus close the gaping mouths of the vessels. This corrugation, if not a perfect equivalent to contraction, for the time answers the immediate object of stopping the hæmorrhage.

It is often useful to reanimate the patient before resorting to manipulative proceedings. In extreme debility, the absorptive power of the stomach is lost; stimulants swallowed are soon rejected, or if retained for awhile are not absorbed. The most excellent plan is to inject a drachm of sulphuric ether under the skin. The rallying effect of this is sometimes surprising. It may be repeated, if necessary, several times.

Practically there are two styptics which claim attention: iodine and iron. The older authors give accounts of vinegar, lemon-juice, and other agents having been used as injections, or by plugs soaked with the styptic. Smellie says: 'The vagina may be filled with tow or rags dipped in vinegar in which a little alum or saccharum saturni hath been dissolved; nay, some inject proof spirits warmed, or, soaking them up in a rag or sponge, introduce or squeeze them in the uterus to constringe the vessels.' But all these things fell into disuse.

Hohl says injection of perchloride of iron was first used by D'Outrepont. Kiwisch warmly praised it. Professor Faye, of Christiania, says (1874) that he has used it in his maternity since D'Outrepont's time. Still it remained practically neglected on the continent, and quite unknown in this country until Robert Barnes introduced it. In the Lettsomian lectures on Placenta Prævia (1857), after a fair amount of experience, he recommended the practice. In publishing the 'Obstetric Operations' he felt strengthened in his conviction that the agent was capable of saving life in emergencies otherwise hopeless. Now, after lengthened experience of his own, confirmed by the testimony of many practitioners in all parts of the world, and notably in London and Dublin, we feel justified in formally recommending the practice. Amongst those who have testified in its favour are A. Farre, Dr. Braxton Hicks, Dr. Lombe Atthill, master of the Rotunda Hospital, Dr. John Byrne, and Dr. Playfair. These and many other distinguished obstetrists have used it, because they found that women were liable to die of hæmorrhage under what are styled the 'ordinary means.'

Iodine proposed by Dupierris ² has been much used since. It is a valuable styptic. But from comparative trials we have made of it with iron, we are satisfied that it is less trustworthy in severe cases. In minor cases it may be used after injecting hot water. The formula is, tincture of iodine \tilde{z} ij, water \tilde{z} viij.

The formula for the iron-styptic is: solid ferric chloride

¹ Beiträge zur Geburtsh., 1846.

² North American Med. Chir. Rev. 1857.

5j., dissolved in ten ounces of water; or of the liquor ferri perchloridi fortior (Ph. Br.) 5jss.; water, 5viijss. The rules in using it are: (1) be sure that the uterus is empty of placenta, blood, and clots; (2) compress the body of the uterus by the hand during the injection; (3) have two basins at hand, one containing hot water, the other the ferric solution, pump water well through the syringe (a good Higginson's will do) so as to expel air, then pass the uterine tube into the uterus, and inject first hot water so as to wash out the cavity and give a last opportunity for evoking diastaltic contraction; then shift the receiving end of the syringe into the ferric solution, and slowly, gently inject about seven or eight ounces, carefully keeping up steady pressure on the uterus throughout and afterwards.

An objection, not without force, has been raised to injection, namely, that it may excite contraction of the uterus, and this contraction may drive fluid along the tubes. To meet this we devised large vulcanite tubes perforated at the uterine end, which was loosely packed with sponge saturated with the ferric solution. When introduced, a piston run down compresses the sponge, and the fluid exudes into the uterus. The plan has its use, but it is less certain than a gentle stream flowing over the whole surface. We now use a strong glass tube, channelled on Neugebauer's plan, which ensures the ready return of fluid from the uterus. Some physicians have advised sponge-swabs. These are bad.

When the hemorrhage is associated with fibroid tumours, the equable conservative contraction of the uterus is almost always frustrated. In these cases it is especially desirable to resort to styptic injections at an earlier stage.

Now it is right to consider the dangers associated with ferric injections. These Robert Barnes examined in a memoir brought before the Obstetric Section of the International Congress, 1881. In the discussion no facts were adduced in proof of the danger of the practice. The cases in which death has followed the method have been subjected to a rigorous analysis by Dr. Pollard.¹

Analysed, the dangers that have been urged may be classed as follows: (1) those accidents which are common to all intra-

¹ Brit. Med. Journ. 1880.

nterine injections, and which have even attended other obstetric manœuvres. After great losses of blood, women have died from shock or syncope occasioned by passing the hand into the uterus; by suddenly sitting up, during the grasping of the uterus from without, under the simple injection of cold water. If, during the deep depression following severe hæmorrhages, the slightest disturbance may precipitate death, it is not easy to understand how a simple injection of cold water, which in itself is capable of causing death, should be made more dangerous by the addition of iron in styptic proportion.

But air may be forced into the uterus and the sinuses, and thence be carried to the heart. Numerous experiments on animals prove that small quantities of air may enter the veins with impunity. In the human subject the experience is mainly drawn from operations about the face and neck. Here a vein has been opened which is within the area of the powerful suction or vacuum force of the chest. The conditions of the uterus differ considerably. Poisseuille denies that there is any suction-force of the abdomen. We are, indeed, satisfied that there is. The downward and upward movement of the uterus, bladder, and anterior wall of the vagina, the intermittent flow of urine by catheter during inspiration and expiration, are experiments in proof; and in a case in which we tapped by aspiration a retro-uterine cyst, there was a backward flow during expiration.

Aspiration to heart. Valsalva proved that at the moment of inspiration the venous blood of the jugulars flows more rapidly towards the chest. Barry proved (1825) that an aspiration was exerted on the veins near the thorax, and gave the measure of this aspiration-force.

Veins would collapse under this aspiration-force unless kept open by attachment to surrounding parts.

The dangerous zone of aspiration extends beyond the region of the neck.

A similar effect is produced on the abdominal side where the vena cava traverses the diaphragm, and at the opening of the sub-hepatic veins. At these points, the blood, compressed by the positive pressure which always exists in the abdomen, finds in front of it the negative pressure of the thoracic cavity, and is thus drawn towards this cavity. Hence, says Marey, entry of air into veins of the abdominal region would be equally to be feared.

Again, the blood returns to the heart from all the venous channels by a centripetal force, and this applies to the uterine sinuses. Besides—and this fact has other important applications—when a woman lies on her side, the flaccid belly and uterus bagging down, if the hand be introduced, air may be felt to rush in along the arm and hand of the operator. But allowing full weight to these facts, death from entry of air into the circulation during ferric injections has not been proved.

As air may enter the veins, so may the ferric solution, and cause clotting of blood in the right heart. Observations of this kind are known as the result of operations upon the face and neck. Only one presumable case of this kind has been observed, that of Dr. Atthill, and this eminent clinician concludes that it is doubtful whether the death was due to the ferric injection. Embolia shortly after parturition is especially to be dreaded after severe hæmorrhages. On the other hand iron has been found in the uterine sinuses; and in the peritoneum carried through the oviduets. In the chapter on the induction of labour will be found other facts bearing upon this subject. Perhaps the most real objection is that some deaths from septicemia have followed ferric injections. The presumed history is this:—clots formed in the sinuses or in the cavity of the uterus, decompose, break up, and supply the blood with septic matter. The cases are open to criticism as to the details of treatment: for example, in some, care was not taken to empty the uterus of clots or placenta, thus directly contravening a fundamental rule. And it must be remembered that septicæmia after childbirth, especially when attended by hæmorrhage, is a too familiar history, even when no kind of injection has been used.

The decision for or against ferric injections, in otherwise uncontrollable hæmorrhages, will rest upon the answers given to the following questions:—1. Is quick death a real danger to be apprehended from hæmorrhage after labour? and where the patient escapes from quick death, is she liable to suffer other serious calamities?

2. Are the proved dangers due to ferric injections greater than those proper to hæmorrhage?

3. Is the use of ferric injections capable of arresting hæmorrhage when other means have failed, and thus of saving life?

Experience supplies the answer. As to the first question, no one who has had a large experience in consulting practice can be ignorant that uterine hæmorrhage has issued in death, or some other sad calamity, notwithstanding the diligent use of what are called 'the ordinary methods of treatment.' The answer to the second is almost a corollary from the first. If death happens from hæmorrhage, what worse can happen from ferric injections? It is assumed that the injection is resorted to because the patient is in danger of death, and, in many such cases, rescue has followed the injection. Is it sound clinical reasoning to contend that because a patient who has been saved from instant death by iron-injection, has succumbed to septicæmia, it would have been better to let her die of hæmorrhage?

As to the third question, the power of ferric injections to arrest hæmorrhage and save life, the evidence is too copious and too precise to be any longer a matter of controversy.

Under a deep sense of responsibility, we feel it a duty to urge that in extreme cases of hæmorrhage of the third degree, in which the diastaltic function is irresponsive, a last appeal should be made to ferric injection. However much we may fear ferric injection, we fear hæmorrhage more, and dare not let a woman die refusing her this last and reasonable chance of safety.

The careful observance of the rules laid down for the use of ferric injections will ensure, if not absolute immunity, at least a minimum of danger that cannot weigh against the dangers of hæmorrhage.

The immediate dangers of shock, entry of air into the veins or into the peritoneal cavity, of the entry of iron into the veins, are reduced to a minimum by placing the patient on her back, and firmly supporting the uterus during the injection. The remote danger of septicæmia is minimised by taking care not to inject iron until the uterus is completely emptied; by washing out the uterine cavity with carbolic injections daily; and by the use of all those means to obviate septicæmia which will be indicated in the chapter on purperal fever.

We now consider the restorative treatment of hamorrhage.

This includes the administration of stimulants and food by the mouth, by the rectum, and by the cellular tissue; Esmarch's bandages; transfusions.

In extreme anæmia, syncope present or threatening, two remedies are instantly indicated. First, place the patient on her back with the head low, and pelvis high, as advised by Nélaton in asphyxia. Iu aid of this proceeding, so as to economisc the blood by keeping it concentrated upon the vital organs, we may adopt the old plan described by Smellie:-Others order ligatures for compressing the returning veins at the hams, arms, and neck to retain as much blood as possible in the extremities and head.' This principle is much better carried out by Esmarch's elastic bands. By the judicious use of these almost all the blood in the limbs may be kept back npon the central organs. Winckel reports favourably of their use in Germany. They may be employed before or at the same time as the immediate means for arresting hæmorrhage. It would be very interesting to take observations by sphygmograph, to illustrate the influence of these bandages upon the heart and arterial system.

Then we resort to stimulants by the mouth. But these are not to be trusted in extreme cases. Anything swallowed is easily rejected by vomiting; and if retained, it is not absorbed. It is no uncommon thing to see milk, beef-tea, and brandy thrown up half an hour or more after swallowing. The stomach, like the utcrus, is paralysed. Better effects sometimes follow stimulant and nutrient enemata. Dr. Sansom¹ recommends for rectal injection defibrinated bullock's blood or Dr. Craven's desiccated blood in the proportion of one drachm to one ounce of water, or it might even be possible to utilise the patient's own blood collected and thrown back into the rectum. But for quick good, the true way is to inject a drachm of ether iuto the cellular tissue. Life has certainly been saved by this means. Absorptiou seems to go on from the cellular tissue after the mucous membranes have lost the power. Hecker of Munich, Macan of Dublin, and others testify to its value. Our own experience is decisive in its favour.

Transfusion.—Of all restorative measures the most direct, the most striking in its effects, is transfusion. It may literally

¹ Lancet, 1881.

save life, palpitating at the last gasp. It would be more extensively practised if certain difficulties were removed. The great object is to simplify the operation. Two things have to be determined. First, the fluid to be used; secondly, the apparatus and other details of the operation. In its ordinary significance, and perhaps etymologically, transfusion means the carrying of blood from one animal into the veins of another. But the term may, for clinical purposes, include the injection into the veins of other fluids as well as blood.

Blood has been used in two states, namely, pure or whole blood as it flows from the veins of the giver, and defibrinated blood. Whole blood is best used by the immediate or vein-tovein method. For this Aveling's apparatus is most convenient. It consists of a continuous elastic tube with a small dilatation in the middle capable of holding two fluid drachms. This dilatation may be likened to the heart of a fish. It may be used to propel the fluid received into it. Instead of valves, which would favour coagulation, the tube is compressed by finger and thumb on the giver's or the receiver's side of the dilated bulb as required. Each end of the tube is mounted with a metal tube for insertion into the veins. The apparatus being ready and emptied of air by driving through and filling with a saline mixture, to be presently described, the veins are bared. The receiver's median cephalic vein is bared by pinching a fold of skin, transfixing this transversely to the vein by a thin knife, dissecting down gently to the vein, so as to expose it for half an inch; a probe may be passed under the vein and pressure kept upon it to save loss when opened. Hine passes a catgut ligature on the vein, and incises above the ligature. The nozzle of the transfusing apparatus is then slipped into the vein directed towards the heart. If Aveling's instrument is used, a little propelling force may be necessary. This should be done very gently. Watch the effect upon the patient. When ten or twelve ounces have been taken in, the operation is usually completed. The cannula is then removed, and a small compress is bound over the wound. The vein of the giver is also secured in like manner. Roussel's apparatus for immediate transfusion attracted much attention some years ago. Having used it as well as Aveling's, we much prefer the latter. Roussel's is too complicated.

There are two natural forces which have aided the transfusion; the driving-force of the giver's heart, which is not unlikely to fail from emotion, and the suction-force of the receiver, also often very feeble. Hence an artificial propelling force is often wanted. This in Aveling's apparatus is supplied by pressure on the bulb.

But a preferable artificial momentum can be had by gravitation, which acts smoothly and admits of most accurate graduation. A gravitation-apparatus is especially adapted to defibrinated blood, milk, or saline solutions. Whole blood may indeed be kept fluid by being protected from contact with air, moving, and cool (Oré), and mixing a little ammonia or phosphate of soda. But with every precaution it is liable to clot, and thus to frustrate the transfusion. Defibrinated blood has several advantages; you may take the blood from the giver in an adjoining room, thus avoiding a great source of emotional disturbance; the defibrination is deliberately performed; the blood thus prepared is free from the danger of clotting; and the whipping brings the blood-globules into contact with air and so takes up oxygen.

Transfused blood does good in two ways: 1st, by mere volume, helping to fill the vacuum left in the circulation; in this way it assists the dynamic action of the heart. 2nd, the red globules help to reconstitute the blood, and carry the healthy stimulus to the nervous centres. But it is of great importance that the blood be thrown in slowly and gradually. If done rapidly the heart may be overpowered.

The value of defibrinated blood is disputed. Hayem condemns its use. Although the proportion of globules may be increased, it is still a question whether they retain their virtue. A condition that follows transfusion is hæmoglobinuria. Landois and Ponfick confirm the observations of Hasse on this point. Albuminuria is commonly associated with it. This especially occurs when the blood of a different species is transfused. The globules of lambs' blood are rapidly dissolved in human serum. This is, says Landois, the source of the hæmoglobinuria. Hayem and Schaefer condemn absolutely transfusion of blood of other animals. Schaefer also condemns milk. He contends that the only fluid which can be employed with any benefit in the

Report to Obstetrical Soc., 1879.

human subject is human blood, either normal or defibrinated. He insists upon the simplest form of apparatus.

Several gravitation-transfusers compete for selection, Little's, McDonnell's, Wagstaffe's (figured in the Obstetric Operations, 3rd ed.), and Hine's (described, Lancet, 1881), have all been approved by clinical experience.

If indicated, transfusion may be repeated.

If blood cannot be obtained, the saline solution used by Dr. Little in cases of cholera will serve. This solution consists of chloride of sodium 60 grains, chloride of potassium 6 grains, phosphate of soda 3 grains, carbonate of soda 20 grains, distilled water 20 ounces, raised to 91° F. Hicks 1 speaks highly of the value of an admixture of a solution of phosphate of soda with blood, whole or defibrinated. The eoagulation is thus prevented, and material for transfusion can be obtained when vein to vein transfusion cannot be accomplished.

Secondary Puerperal Hæmorrhages.

Primary or paulo-post-partum hæmorrhage may have been arrested, and yet, twenty-four hours or later, bleeding may again break out. At this time the involution-process has begun. The uterus ought to be sensibly diminished in bulk, and firm. Only the lochial discharge should be going on. This varies in amount in different women. On the second day the discharge is still sanguineous, but serous fluid predominates. Day by day the proportion of red blood lessens, the discharge assuming a more watery character, tinged from red to dirty green—'the green waters.' By the end of a week the discharge is commonly muco-serous, still tinged with green. Some muco-serous discharge goes on for two or three weeks more.

The day after labour, in pluriparae, it is not uncommon for a large clot to be passed. This is preceded by 'after pains'—that is, by colic or spasm of the uterus. Commonly relief is obtained when the clot is passed. The uterus contracts firmly, and there is no more bleeding. But in delicate women of lax fibre, especially in pluriparae, and after exhausting labours, it is not uncommon for the uterus to become distended by blood, which clots and is retained, the serous part escaping. This is

¹ Obstetrical Transactions, 1879.

paulo-post-partum hamorrhage. At this time there is restlessness, uterine pains, tenderness on pressure over the hypogastrium. On loosening the binder to feel the uterus accurately, this is made out rising above the symphysis, perhaps halfway or more to the umbilicus. The first thing to do is to pass the eatheter. A full bladder would interfere with the necessary manipulation, and is itself a cause of defective uterine action. The next thing is to grasp the uterns firmly, to squeeze ont its contents, then apply a pad and binder. Any hæmorrhage after this is puerperal or secondary hæmorrhage—a symptom to be vigilantly watched, since it is a source of danger by itself, and also by being frequently associated with septicæmia.

The causes of secondary homorrhage. If due care have been taken in the conduct of the labour, and especially in the management of the placenta and any primary homorrhage, we shall rarely experience the mortification of seeing secondary homorrhage. This will be evident if we trace the principal ascertained causes of secondary homorrhage. These are:—

A. Local Cause of Secondary Hæmorrhage.

- 1. A portion of placenta or membranes has remained in utero.
 - 2. Clots of blood may have formed and been retained.
- 3. Laceration or abrasion of the cervix, vagina, or perinæum, or a vesico-vaginal or vesico-urethral fistnla.
- 4. Hæmatocele or thrombus of the cervix, vagina, vulva, or perinæum.
- 5. Chronic hypertrophy, congestion or ulceration of the cervix uteri.
 - 6. Malignant disease.
 - 7. General relaxation of the uterine tissues.
 - 8. Fibroid tumours and polypi.
 - 9. Inversion.
 - 10. Retroflexion, retroversion, or anteflexion of the uterus.
 - 11. Pelvic peritonitis or cellulitis fixing the uterus.

B. Constitutional or Remote Conditions causing Disturbance of the Nervous and Vascular Systems.

- 1. Emotions.
- 2. Sexual intercourse.
- 3. Returning ovarian action, recurring commonly at the end of a month, or ovarian action, favoured by failure to suckle, and imperfect involution of the uterus.
 - 4. Heart disease, including imperfect involution.
 - 5. Liver disease.
 - 6. Bright's disease.
 - 7. Leucocythæmia.
- 8. General debility of tissue, mal-nutrition of nervous system, and irritable heart from anæmia.
- A. 1. Retained Placenta.—It will be seen at once that some of these causes may be averted. This applies especially to A. 1., retention of placenta. It is, however, the condition most frequently met with. The flooding has usually set in within twenty-four hours of labour. The explanation has mostly been that rigidity of the cervix uteri rendered the removal of the placenta impossible. In some cases the attendant was not aware that anything had been left behind. We have in several cases removed the whole placenta a week or more after labour. Flooding is not always the most urgent symptom. Septicæmia almost always attends, just as we see in abortions in which a portion of the ovum is retained. Hence we get the signs of septicæmia, of fever, which will be described in its place. The local objective signs are: some distension of the abdomen, tenderness on pressure over the utcrus, which is felt rising towards the umbilious; by vagina, the uterus is felt enlarged, the cervix more or less open, admitting one or two fingers; a discharge, muco-purulent, sanguineous, generally of peculiarly offensive odour; and sometimes retention of urine. These signs indicate the necessity of exploring the cavity of the uterus. The sound will give the measure of the uterus. But the only satisfactory examination is made by touch. Sometimes the finger can enter the uterus by pressing the hand firmly against the perineum; and sometimes the vulva and vagina are lax enough to enable the hand to pass into the vagina, and thus one or two fingers passing into the uterus, aided by pressing the

fundus down upon it by the hand outside. But generally this indispensable operation is too painful to be carried out without anæsthetic help. The exploring finger must sweep the whole inner surface of the uterus, hooking down and detaching any adhering placenta or clot.

When the uterus is emptied, wash out with carbolised water,

1 in 50.

- 2. Retained clots.—The same treatment must be pursued in the case of retained clots.
- 3. Laceration or abrasion of the cervix is more frequent than is commonly supposed. Hemorrhage from this cause is sometimes protracted and copious. The diagnosis is established partly by the method of exclusion. You explore the interior of the uterus and find it empty, perhaps well contracted. Then through a speculum, wiping away any obstructing blood or clot by sponge, you see the lips of the os uteri; swab the raw surface with solution of perchloride of iron, apply dry cotton-wool, and gently plug with lint which has been soaked in carbolised water. The plugs can be removed and the treatment repeated if necessary. If the rent be extensive, the question of stitching up at once by wire or silk sutures may be considered. Emmet says even moderate rents frequently cause cellulitis at the time, and arrest involution. His operation may be done some time afterwards.

Laceration of the Vagina or Perinœum.—These have been discussed in connection with rupture of the uterus. They may be detected by visual and digital examination. Compresses of perchloride of iron may be necessary. A little bleeding may also continue from vesico-vaginal or recto-vaginal fistulæ, but as these injuries partake more of the nature of sloughs than of rents, they rarely cause anxiety on account of the hæmorrhage.

4. Thrombus or Hamatocele is described in the next

section under B.

5. Chronic hypertrophy, or ulceration of the vaginal portion, will be detected by touch and speculum. The part may be touched with nitrate of silver or tincture of iodine. Astringent lotions will be useful.

6. Malignant disease has been described elsewhere.

7. General relaxation of the uterine tissues is mostly associated with systemic debility and mal-nutrition. Constitutional

treatment is especially serviceable. Irou, strychnine, phosphoric acid, quiuiue, and ergot are valuable. But the intra-uterine application of iodine every three or four days is useful.

- 8. The complication of fibroid tumours and polypi is discussed in the chapter ou Dystocia. If first discovered some days after labour, the treatment is still the same as that recommended when found at the time of labour. In the case of tumours we must restrain hæmorrhage by the topical application of perchloride of iron. Sometimes the tumours can be removed by enucleation. Polypi should be removed by the wire-écraseur.
 - 9. Inversion is discussed in the succeeding chapter.
- 10. Retroflexion of the uterus is a frequeut cause of secondary hæmorrhage. The displacement occurs soon after labour, the heavy fundus falling backwards, while the tissues are in a relaxed state. Iu a considerable proportion of cases there had been retroflexion before the pregnaucy. In such cases the displacement is especially apt to recur and to persist. The diagnosis is made out by the fingers in the vagina feeling the rounded mass of the fundus uteri behind the os, bulging downwards and forwards the posterior and upper part of the vagina; by the finger in the rectum, which determines the rounded mass of the fundus even more accurately; by the finger in the vagina passing up in front of the os uteri to meet the hand pressed down from above the symphysis, revealing the absence of the uterus between them; and still more absolutely by the uterine sound, the point of which must be turned back to euter the body of the uterus. The finger pressing upon the posterior down-looking wall of the uterus lifts it up, aids the entry of the sound, and partly restores the true position. The treatment consists in completing the reduction of the uterus; it should then be maintained in situ by a Hodge pessary. If bleeding continue, the cavity should be swabbed with iodine or perchloride of iron. The constringing effect of this, by lessening the bulk of the uterus, tends still further to correct the retroflexion.
- 11. Perimetritis fixing the uterus.—When this condition arises, involution is impeded; the uterus becomes engorged from the impediment to its circulation; it cannot fairly contract. There is also some shedding of epithelium from the cervical

cavity and os externum. Hence bleedings are frequent. Rest and quinine best promote absorption of effused fibrin. The bared surface may be touched occasionally with iodine or nitrate of silver. Intra-uterine injections of hot water, 110° Fahr., are of striking efficacy.

- B. The management of secondary homorrhage depending upon constitutional or remote causes must obviously consist in avoiding or lessening the influence of those causes.
- 1. Emotions.—Some women are so excitable that the mere application of the child to the breast will cause hæmorrhage. Here we have an example of the influence of breast-irritation acting unfavourably. The normal influence of suckling is to promote uterine contraction and involution. It may thus be regarded as a provision against hæmorrhage.
- 2. Sexual intercourse.—The fact is commonly concealed; but the cause is in some cases real.
- 3. We may observe the *influence of ovarian irritation* in the not infrequent occurrence of hemorrhage exactly a month after labour. This is more especially the case where suckling has not been instituted. The ovaries then more readily assert themselves, and resuming work, excite the menstrual flow, which easily exceeds the normal quantity, assuming the proportions of hemorrhage.

In the greater number of cases considered the evil does not end with the secondary hæmorrhage. The causes continue to work—unless carefully dealt with at once—for an indefinite time, and lay the foundation of chronic uterine diseases, as sub-involution, hyperplasia, menorrhagia, dysmenorrhæa, and displacements.

4. Thrombus or Hæmatoma.—This is a form of hæmorrhage sometimes occurring before labour, more frequently during labour, and sometimes becoming recognised after labour. In these latter cases the injury leading to the bleeding was caused during the labour.

Thrombus consists in a collection of blood forming in the submucous tissue or connective tissue. It may occur in the cervix, in any part of the vagina, in the labia vulvæ, and in the perimetric connective tissue.

What may be called a diffused thrombus occurs in almost

every labour. Under the enormous distending pressure upon the cervix caused by the advancing head, the mucous membrane carried down by the head glides on the deeper tissues by a glacier-like movement. The connecting sub-mucous vessels are torn; blood is extravasated in the form of ecchymoses or small thrombi. This, we believe, is nearly universal. At least we have seen evidence of it in every autopsy of recently delivered women that has come under our observation.

This ordinary form of thrombus will throw some light upon the more pronounced and recognised forms.

Thrombus may occur at any period of pregnancy. It is more frequent as the time of gestation approaches. It is most common during labour.

The predisposing condition is found in the great capillary and venous development in the parturient canal during gestation. The veins, we have seen, are frequently varicose, always excessively full of blood, with a tendency to stagnation. This is aggravated by the pressure of the gravid uterus upon the pelvic vessels. This tells more especially upon the vulva. If in this case unusual pressure upon the parts above be applied so as to retard the return of blood, slight causes may lead to the vessels bursting. The rupture of the vessels is commonly the result of the excessive distension to which they are subjected by the pressure upon the soft parts above. Occasionally the tumour is developed rapidly before the head comes down to the outlet, forming a mechanical obstacle to the completion of labour. The distension is at times so rapid and great that the walls burst, and considerable hæmorrhage of an arterial character takes place. But more often, although the rupture of the vessels may occur before the passage of the child, the tumour is developed gradually after its birth. The passage of the head, carrying before it the inner layer of the labium, increases the lesion of the vessels. These post-partum thrombi are especially dangerous, partly because they are more liable to be overlooked. They may burst after their walls have undergone mortification.

Acute pain generally marks the beginning of the thrombus, due probably to the rupture of the vessels and the stretching of the tissues before the outpouring blood (Caseaux). The effusion may be limited to the loose connective tissue of the vulva;

but it may be very extensive. Thus, Cascaux relates a case in which he traced the blood dissecting up the peritoneum, all up the iliae fossa, where it formed a large coagulated mass; it extended, still behind the peritoneum, up the left and posterior part of the abdomen, as high as the right hypochondrium, bathing all the cellular tissue surrounding the kidney, and even to the attachments of the diaphragm.

If the tumour burst, the hæmorrhage may be so great and rapid as to prove quickly fatal. If it fail to burst it may become so large as to close the vagina, and lead to retention of lochia (Lachapelle). It may also lead to retention of urine and fæces.

The Issue and Prognosis.—When death occurs it is usually from hæmorrhage internal or external. Gangrene or suppuration may prove fatal at a later period. Cases have ended by resolution, suppuration, bursting, peritonitis, or septicæmia.

Hugenberger thus summarises 1 the issues of the puerperal hæmorrhages observed by him: 1. Perineal hæmatoma before labour, consecutive abscess, perforation of rectum, recovery.

2. Labial hæmatoma before labour, suppuration of the burst blood-gathering, pyæmia, death. 3. Labial hæmatoma before labour, suppuration of the burst gathering during puerpery; fatal metro-peritonitis and pyæmia. 4. Labial hæmatoma, bursting, recovery. 5, 6, 7. Labial hæmatoma, incision, recovery. 8, 9. Peri-vaginal hæmatoma after labour, bursting, recovery. 10. Peri-metric during labour; violent labourpains, fatal hæmorrhage. 11. Perimetric after labour, with cross-birth and turning, bursting of the sac, and death by bleeding into the abdominal cavity.

The prognosis is serious. Deneux collected sixty-two cases, of which twenty-two were fatal. In two of these the child was also lost. But we think this statement of the mortality would be reduced could we obtain a larger number of cases, including cases of all degrees of severity.

The Course and Symptoms are well illustrated in the following clinical illustrations. A patient of the Royal Maternity Charity was the subject. Primipara, labour ordinary. Following labour the midwife observed a mass protruding externally, which she took to be the bladder and vagina prolapsed.

¹ St. Petersburg. medic. Zeitung, 1865.

She was seen by us two hours after labour. There was a soft tumour, the size of a child's head, projecting from pubes to anus. In front it seemed tense, shining, translucent; fluetuating; its side presented similar characters; the circumference, the base, was continuous with the skin of the labia and thighs. Posteriorly was an inflexion of the tumour, having an anterior lip much eechymosed, and the posterior lip forming a sharp crescent, the whole much resembling the os uteri after labour. Pursuing examination up this orifice we found that the swelling was eaused by enormous distension of the labia vulvæ, especially of the left labium, by blood and serum. On the internal aspect of the left labium, about one inch from the orifice, was a jagged hole, which communicated with the sac formed by the effusion in the labium. Through this some sanious matter escaped on pressing the swelling. It was a rent made in the mueous membrane by the head during delivery. The tumour quickly diminished during the next two days, and the woman did well. It is not common to find the tumour so large as in this case.

The following is equally instructive, and illustrates another point in the subject. Hypertrophy of the cervix, procidentia, hæmatoma. A midwife of the Royal Maternity Charity sent in great alarm, thinking the entire uterus had come out after the child and placenta. We found the patient prostrate, eold, agitated; a large mass lay forth beyond the vulva, of dark colour, like coagulated blood, resembling in bulk and aspect the placenta. We next thought it might be the inverted uterus. Some hæmorrhage eame from it. The mass was soft, its covering easily tearing on slight pressure; it was found to eonsist of two lobes, and between them was an opening admitting two or three fingers some distance. This was the os uteri; the two lobes were the lips of the eervix uteri, enormously enlarged by infiltration with serum and blood. On pressing the mass to reduce it, the mucous membrane easily tore, and blood oozed out. To guard against this the mass was covered with a napkin; then by eareful and gradual compression it was returned within the vagina. A perinæal compress was applied to prevent descent. The patient did well. This was a most aggravated example of the contusions and injury which the cervix is liable to during labour. It was greatly elongated and hypertrophied.

We have some reason to believe that a varicose condition of the cervix, similar to that which so frequently exists in the labia vulvæ may lead to thrombus of the cervix.

Dr. Gustavus Murray relates a case in which severe hæmorrhage occurred in two successive labours before the passage of the head. The source appeared to be the bursting of a mass of varicose veins—a form of hæmatocele—just within the lower zone. On one occasion hæmorrhage recurred a fortnight after labour.

Perimetric thrombus or hamatoma.—Effusions of blood are occasionally recognised in the connective tissue of the broad ligaments, in the mass of connective tissue connecting the cervix uteri with the base of the bladder, and in the connective tissue between the lower part of the posterior wall of the uterus and the rectum, where the peritoneum is reflected off. Probably minor degrees of effusion of blood in the broad ligaments are not uncommon; they may rapidly disappear by absorption. Certainly serous effusion in this place is common, if not universal. We believe these blood-effusions are sometimes a factor in the origin of pelvic cellulitis or parametritis.

Blood-effusion in the utero-vesical mass of connective tissue we have detected several times. These effusions are recognised by the same objective signs as pelvic cellulitis. The differentiation is made by observing the time at which they form. Hæmatoma becomes manifest within a few hours of labour; the inflammatory effusions take several days to develop, and are not commonly pronounced before the tenth day.

The diagnosis is not always easy. When the tumour has attained a moderate size it presents a shining aspect of purple or bluish-black colour. It tends to occlude the entry of the vagina, whilst the finger, passed above it, defines its extent and relations. The rapid formation with pain, the fluctuating feel of the tumour whilst recent, and its hardness if the blood has coagulated, are characteristic.

The treatment.—Is there any prophylaxis? The treatment will depend upon the stage when the effusion is observed, its degree, and other accidental conditions. If it form before the descent of the child, we may first endeavour to restrain the effusion by ice and pressure. If this is not successful, whether the tumour by its bulk impede labour or not, it will be better

to open it by the lancet, and to deliver by forceps. Thus the danger of further injury under the attrition of the head is lessened. If the tumour have burst and hæmorrhage be at all profuse, the first effort should be to deliver by forceps if the head present. Thus we shall be in a position to apply means to arrest the bleeding.

When the case comes under care after labour, Fordyce Barker advises to enlarge the opening by ineision, to elear out the clots; and to compress the cavity with lint soaked in solution of iron. When the hæmorrhage is fairly arrested, care is required to obviate sloughing and septicæmia from decomposition of the clots. The styptic plug should be replaced by dressings with carbolic acid oil, and frequent syringing with a solution of carbolic acid (1 in 50). It is well to remember that hæmorrhage may arise from laceration of the vulva apart from thrombus. The great principle of 'rest' finds useful application here.

The Consequences of Hæmorrhage.

These are often serious, and prophylactic treatment is important. In many cases it is true that women recover in the most surprising manner after formidable losses. But every woman who has lost much should be carefully watched. The quality of the blood remaining in the system, as well as the quantity, is altered. There is more fibrin in proportion to the globules. The circulation is especially open to accumulation of waste-matter from within, and to invasion by noxious matter from without. These conditions are the essential factors of two graver affections—thrombosis and septicæmia. These will be studied by-and-by.

Hughlings Jaekson records ('London Hosp. Reports,' vol. i.) a case of hemiplegia of the right side and loss of speech following on severe flooding. Power gives examples of blindness.

One of the most immediate dangers is syncope. Under the depressed state of the nervous and vascular system, the low tension, any disturbance physical or psychical may cause such perturbation that the heart is easily overpowered. It ceases to beat. This syncope is sometimes associated as cause or effect with thrombosis and embolia. But sometimes no blood-clotting is found in fatal eases; and some recover. To obviate this

danger, the recumbent posture with the head low should be rigorously observed. Nourishment should be carefully attended to. Light soups, or easily digested food, should be given in small quantities at short intervals. Moderate doses of stimulants, as brandy or champagne, must be allowed. Ether, compound spirits of ammonia, bark and cinnamon may be usefully combined; sometimes opium. The great principle that rules over all is to enforce the most absolute rest, encouraging sleep and peace of mind, and removing every source of emotion. Two persons should help in washing the patient, changing the linen, or making the bed, so as to avoid exertion on the part of the patient.

CHAPTER VI.

ACCIDENTS OCCURRING DURING AND FOLLOWING UPON LABOUR, continued—Lesions of the parturient canal—rupture— INVERSION—RETROVERSION—SUBINVOLUTION—RETENTION OF PLACENTA.

Any part of the parturient canal may suffer injury before and during the act of labour. The immediate cause may be (1) spontaneous or autogenetic, that is, due to some disturbance arising in the course of gestation or labour; or (2) the result of violence inflicted from without.

Rupture of the uterus has this affinity to the Cæsarian section, that it is sometimes produced by conditions similar to those which determine us to perform the Cæsarian section. Indeed, a leading motive for resorting to this operation is to avoid rupture. And where rupture has occurred, it is commonly necessary to open the abdomen in order to remove the fœtus. There are, in fact, cases of dystocia in which Nature, unable to effect delivery per vias naturales, seems, by rending open the uterus and extruding the child into the abdominal cavity, to endeavour to accomplish that which the surgeon accomplishes by cutting open the uterus after laying open the abdomen. It rests with the surgeon to meet nature half way, by performing abdominal section, to get at the child cast out into the abdominal cavity.

There are few subjects in obstetric practice more interesting, or possessing a wider range of relations, than rupture of the uterus. A full knowledge of the conditions under which the aecident may arise, of the symptoms and terminations, is of the highest importance in medical and in medico-legal relations. The accident rarely happens without some imputation or suspicion of malapraxis, by omission or commission, falling upon the medical attendant. Even if he escape censure from others,

he may not escape the torture of self-reproach. And he may deserve neither.

It is therefore of the last importance to be well-informed as to the circumstances which lead to this terrible catastrophe; and, when it has happened, to know what to do, and what not to do, not alone in the interest of the patient, but also, reflecting on the fearful penalties under which we practise, in our own. It is in the very nature of the accident that it commonly happens suddenly, without warning, and that it thus precludes the surgeon from using means to avert it. 'We have been' more frequently consulted in criminal charges connected with rupture of the uterus than with any other obstetric casualty. In almost every instance the conclusion that the accident arose from unavoidable causes proved to be the best founded.'

Frequency.—In 154,303 labours summed up from various sources, 117 ruptures, or 1 in 1318, were observed.

The uterus may undergo (1) rupture, or bursting; (2) laceration; (3) grinding, or crushing; (4) perforation; (5) avulsion, or tearing away.

Definitions.—It is desirable to attach definite meanings to certain terms. By so doing we shall at once effect a natural classification of cases that will much simplify the inquiry.

- 1. Rupture or bursting occurs when, under strong tension of the uterus upon its unyielding contents, its walls burst more or less suddenly in the body or cervix.
- 2. Laceration or rent occurs when a breach begins at the edge of the os uteri, and extends.
- 3. Grinding or crushing occurs when the uterus is subjected to long compression between the child's head and the pelvic wall.
- 4. Perforation or boring through occurs when tissues give way from disease, or long compression at one point, or from penetration by a spike of bone or by instruments.
- 5. Avulsion. The uterus has been torn away by manual force.

Ruptures, again, are spontaneous, or inflicted from without.

Ruptures may be *complete*, that is, involving all the tissues of the uterus; or *incomplete*, involving only a part of the wall.

Robert Barnes: Obstetric Operations, 3rd ed.

- The following general propositions may be stated:—
 1. The non-pregnant uterus may burst.
 2. The uterus may burst at any period of gestation independently of labour proper.
- 3. Any part of the parturient canal may be lacerated during labour. But the most common seat is the cervix.
- 4. By far the greater number of cases occur during labour at term.
- 5. The uterus will not burst unless it be in a certain degree of tension from containing something in its cavity.

 6. The uterus may burst in child-bearing women of all ages; in women pregnant for the first time, or in women who have borne one or more children; but by far the greatest number of cases occur in pluriparæ.
- 7. The healthy uterus may undergo spontaneous rupture.
 It is more in accordance with clinical and pathological history to take the varieties of uterine lesion successively; to study them separately at first; and then to consider their natural relations and common features. For example, the cases of rupture or bursting differ essentially in their etiology from the cases of grinding or perforation.
- 1. Bursting or rupture.—This lesion most frequently begins in the uterus. The uterus contracting forcibly, either suddenly or persistently, upon its unyielding contents, as when the liquor amnii is present and the cervix does not yield a vent to relieve the tension, under the law of fluid incompressibility the uterus must burst. The only compensating factor is the small amount of oozing of liquor amnii through the uterine wall. This can rarely be sufficient. The uterus may also burst, struggling upon solid contents.

 Causes.—These are sometimes complex. The explanation

Causes.—These are sometimes complex. The explanation most commonly given of rupture of the uterus is that it is produced by obstruction to labour. The history of the great majority of reported cases proves that obstruction to labour was the immediate antecedent. But this explanation can scarcely apply to those cases where the uterus suddenly bursts during pregnancy, when there is no labour, properly speaking. The immediate cause is comprehensively stated in the following proposition ('Obstetric Operations,' 3rd ed. p. 323):—'The uterus ruptures because there is a loss of balance between the expelling power of the body of the uterus and the resisting power of the parturient canal, the resisting power being in excess.'

Violent action of the uterus is sure to evoke reflex or voluntary action of the abdominal muscles. Trask, analysing the 417 cases he had collected, says: 'Inordinate voluntary exertion deserves to be enumerated among the causes of rupture. We believe no case of rupture has yet been (1856) published in which chloroform was used, which may be due to the fact that voluntary effort is greatly suspended under its influence.' We cite this statement in order to draw attention to the negative evidence borne in favour of chloroform. If rupture has since Trask's time been observed under chloroform, it is important that the cases should be recorded. Tyler Smith says:—'In ordinary labour, some amount of voluntary or instinctive action of the muscular system, and particularly of the expiratory muscles, is quite natural during the stages of propulsion and expulsion. In acute or severe labour, these voluntary exertions are productive of great mischief, as laceration of the uterus, and perinæum, or exhaustion.'

Obstruction to the extrusion of the contents of the uterus obviously lies at the foundation of nearly all, if not of all, cases of lesion of the parturient canal. The empty uterus can hardly be supposed to rupture itself.

If we cannot state with precision the exact causes of rupture, we may arrive at valuable practical knowledge by studying the conditions under which rupture has been observed to occur.

1. Rupture may take place in the non-gravid uterus. Duparcque cites cases.\(^1\) But in these cases disease of its tissues, as thinning, softening, degeneration, or abscess, appears to be a necessary condition. Other factors are: closing of the os and accumulation of fluid in the cavity. Perforation by cancer—a distinct event from bursting—is not uncommon.

We do not dwell in this place upon the cases of direct injury to the uterus by wounds. Such may of course occur at any time. It is well to remember that blows inflicted upon the pregnant womb, may wound, even kill the child, without causing rupture of the womb. Duparcque gives an example. 2. Rupture during gestation.—It has been stated that sudden violent efforts of the child have caused rupture. The cases cited in support of this proposition are not convincing. It is more probable that the uterus, excited by violent action, ruptured itself, or that some violence external to the uterus was concerned.

Spontaneous rupture is rare, but the accident is well authenticated. Indeed it is not more surprising than spontaneous rupture of the heart. It is known to have occurred as early as the third month. Mayer relates (V. Siebold's 'Journ. f. Gebtsh.' Bd. III.) a case of rupture in the third month. The uterus had been the subject of Cæsarian section. H. Cooper ('British Med. Journal,' 1850) saw a pluripara of 30, who was taken with collapse after dancing, and died next day. The uterus was found torn at the left side of the fundus, a three months' fætus projecting through the rent. The tissue at the part was thin, pulpy, cheesy. There was tubercular degeneration. Duparcque gives an example in which the cause assigned was vomiting. It has occurred in the fourth month. Dr. McKinlay relates a case ('Glasgow Med. Journal,' 1861). Without any exertion or injury a woman died after being taken ill the previous night. The uterus was ruptured across the fundus. Its tissue was apparently healthy.

It has also happened from violent exertion and fatigue or injury, as a blow or a fall, or from severe vomiting. The influence of over-exertion is illustrated in a case by Duparcque. A woman was carrying a weight on her head, when symptoms of internal injury set in; she rallied for a time, had another attack, and died. The uterine cavity contained a fœtus of three or four months. There was a fissure in the fundus near the right tube. This was probably a case of gestation in one horn of the uterus.

Dr. Harrison ('Amer. Journ. of Med. Sc.' vol. viii.) relates the case of a pluripara, who in the *fifth month*, after a long walk, felt a sudden and severe pain 'as if something had given way within her.' She died in a few hours. Blood and the fætus in its membranes were found in the peritoneal cavity. There was a transverse rent from one Fallopian tube to the other. There was no thinning or appearance of disease. Such a case as this and succeeding cases support the theory of bursting set forth at page 313. Collins relates a fatal case at five months. Hohl cites from Mangold a case of rupture at the fifth month.

The late Mr. Scott, of Bromley, relates ('Medical Repository,' vol. viii.) the case of a woman in the sixth month, who was awakened from sleep by a sudden pain about the umbilicus. Rupture of the uterus was found at the fundus, through which the fœtus enveloped in its membranes had escaped into the abdominal cavity.

Mr. Mitchell relates ('Obstetrical Transactions,' 1870) the case of a woman in the seventh month, who died after sudden abdominal pain caused by terror from lightning. The uterus had burst apparently under contraction upon the projecting knee of the fœtus. Other cases will be found in Trask's Memoirs ('Amer. Journal of Med. Science,' 1848 and 1856).

Some of the ruptures in early gestation were not examples of ordinary uterinc gestation, but were undoubtedly ectopic. Thus, Canestrini relates a case in which there was a double uterus. One of the uteri, after some pains in the fourth month, burst. The ovum was found entire in the abdomen. Goupil cites a case from Payan, of a woman who died under symptoms of shock, causing suspicion of abortion having been procured. Above the proper cavity of the uterus was another cavity found in the wall. This interstitial cavity had become thinned by the growth of the ovum, and burst. This case was probably an example of gestation in the undeveloped horn of a double uterus. The reader is referred back to the history of 'ectopic gestation' for further information upon this point (Vol. I.).

Spontaneous rupture in early pregnancy is so rare that suspicion of foul play is easily excited. The vagina and uterus have been frequently wounded by instruments used to procure abortion. The character of the wounds may differ from those due to spontaneous rupture. They will show evidence of cutting, stabbing, or bruising, according to the nature of the instrument used. A careful microscopical examination of the tissues, especially at the seat of the lesion, should be made. If found perfectly sound, the presumption that injury has been inflicted from without will be strengthened. This applies almost exclusively to rupture during early gestation. In ruptures at term, disease of tissue is rare, notwithstanding current opinions to the contrary.

In the eighth and ninth months, spontaneous rupture is less rare. The influence of emotion is again in evidence. Francis White ('Dublin Journ. of Med. Sc.') gives the history of a woman near the end of gestation. She fainted under terror, was delivered a week after, and died almost immediately. A large quantity of blood was found in the abdomen. The rents were seen in the anterior part of the womb, involving the peritoneal coat and some muscular fibres.

Rupture or bursting at term, or on the advent of labour. —In this order of cases the reversal of the normal relation between active uterine force and passive resistance is more obvious than in early pregnancy. In a large number of cases there is decided mechanical resistance to the expulsion of the fœtus, or to the bursting of the ovum and discharge of the liquor amnii. It is remarkable that rupture of the uterus has frequently happened long before obstruction to labour could be encountered. These cases are similar in the mode of production to those which occur early in gestation, and to bursting of the gestation-sae in ectopic gestation. There is one striking point of resemblance: namely, the frequency with which the entire ovum is cast out into the peritoneal cavity. In this respect they differ from many cases of laceration which occur during obstructed labour, in which the child, or at any rate the placenta, is more commonly retained in the uterus. The explanation of these cases appears to be that the uterus is excited to contract suddenly. The ovum being entire, the resistance is hydrostatic. The contents of the uterus are then incompressible. The conditions are analogous to those of the famous Florentine experiment. There is no provision for the diminution of the bulk of the contents of the uterus by the opening of the os uteri. Under these circumstances, a moderate contracting force may result in bursting. There can be no doubt that in many cases this catastrophe is averted by the facility with which the membranes burst. Thus abortion may be looked upon as an alternative of rupture. On the other hand, the uterus will often stretch, and in this way also bursting is averted. It is the lower segment, and cervix especially, that stretches. But stretching is a process that requires time. A sudden contraction, such as is induced by emotion, gives no opportunity for this, and so the tissue gives way. Belonging

to this order are cases of over-distension of the uterus, from twins or triplets. Under these conditions, although the uterus grows in some measure to keep pace with the increasing bulk of its contents, the rate of accommodation is liable to be outstripped by the distending force. The uterus becomes thinned out, stretched—therefore weakened. If the thinning happen to be more marked at one part, rupture at that part is very likely to happen if a sudden contraction occur. And especially is this likely if the tissues have undergone morbid change.

This is the more likely to happen, because distension of the uterine fibre is very apt to cause vomiting; and vomiting has been noted as a factor in the production of rupture. The retroverted gravid womb has been driven through the vagina, tearing its way through. This proves the force that can be exerted by the abdominal muscles (see 'Retroversion' in 'Obstetric Operations'). An ovarian tumour may, in like manner, be driven through the vaginal wall.

The influence of disease of tissue as a factor.—Reasoning from the observation of some cases in which the uterine tissue was altered by disease, and partly from the analogy of rupture of the heart, the opinion has found favour that alteration of tissue from disease is a necessary condition to rupture. It is affirmed that a healthy uterus will not rupture. The supposed analogy is fallacious. The uterus bursts, as has been shown, under strong contraction upon incompressible contents that cannot escape. This cannot be the case with the heart. Or in other cases, the uterus tears itself by pulling upon a fixed point, as where the head jams the lower segment of the uterus in the pelvic ring, or as when the uterine fibres pull upon a projecting limb. There is nothing like this in rupture of the heart. Still, it is true that there are cases in which the uterine tissue gives way from disease, like the heart.

The hypothesis that alteration of tissue was a necessary antecedent to rupture was clearly insisted upon by Murphy. He described a *softening* of the tissue as the result of inflammation during pregnancy, as an indication of which there is frequently pain in a particular spot.

Fatty degeneration is the change most frequently described. Klob distinctly 1 says that he has in several cases of spon-

¹ Pathol. Anat. der weiblichen Sexualorgane.

taneous rupture observed fatty degeneration of the muscular wall at the place of rent. In confirmation, reference is made to the normal process of involution of the uterus, in which, at the end of pregnancy, some molecular change occurs in the muscular cells. If it be held that the ordinary kind and degree of granular change is sufficient to impair the strength of the tissue to the extent of causing it to rupture; it must be enough to point out the extreme improbability of Nature's so bungling as to weaken the uterine tissues at the moment when the greatest vigour and resisting power are needed. If it be urged that this physiological condition may pass into pathólogical excess, an argument is used which is more difficult to refute; the more so because, in some cases, direct observation seems to prove that excessive fatty degeneration did exist. But to prove that a particular factor existed in a limited number of cases is very different from establishing it as a general or universal law. And there is abundant evidence to prove that in a considerable number of cases no such excess did exist. 1. Many ruptures have occurred during gestation at periods when even the physiological change is rare—in some of these, the healthy condition of the tissues was established by competent observers. 2. A certain proportion of cases occurring in labour at term were in primiparæ, in whom the presumption is strong against morbid change of tissue. 3. In many cases of rupture at term in pluriparæ the tissue has been found healthy. In four cases examined by Robert Barnes this was the case. In one of these this fact was verified by Dr. Bristowe and Dr. Montgomery. Cohnheim and Bandl found the tissues sound. 4. In not a few cases, recovery, with perfect healing of the wound, has occurred. Duncan's experiments on the power of the uterus to resist bursting, were made on bits of uterus taken from the body of the organ. Because it was difficult to apply force enough to rupture these pieces, he drew the conclusion that the sound healthy uterus could not burst. 'The fallacies vitiating this conclusion are obvious. The uterus rarely ruptures at its body, but almost always at the cervix and lower segment; and pressure applied to a detached bit of dead tissue is altogether different from what obtains in the living uterus.

Bandl¹ distinctly affirms that the healthy uterus ruptures itself; and says that, because women die of exhaustion without rupture, it is no proof that a sound uterus cannot burst. On the other hand, the frequency of rupture in pluripare, in women about forty years of age, who have led a hard life, whose system has been generally enfeebled, makes it reasonable to infer that the uterus partakes of the general weakness or degradation of tissue. In two of the cases seen by Robert Barnes, the muscular fibres of the heart exhibited marked granular change. He describes a similar condition in the heart of a woman who died of accidental hæmorrhage; she was also a pluripara, aged about forty, much worn by poverty and hard work. In fact, accidental hamorrhage and rupture of the uterus are apt to occur in the same class of persons. Moreover, in some cases of accidental hemorrhage, the uterine fibre has actually been observed to be torn. Iu one case of rupture seen by us, there was albuminuria at the end of pregnancy; the kidneys were found in an advanced stage of Bright's disease.

E. L. Ormerod relates ('Bartholomew's Hospital Reports, 1868') the case of a woman in her fourteenth pregnancy; the rent extended from cervix to fundus. He found follicular disease about the cervix, and fibrous degeneration of the adjacent muscular tissue.

C. Braun describes a *peculiar hyperplasia* of the uterus, in which the body and cervix lose their due relation to each other.

Cancerous degeneration, especially of the cervix and lower segment, has often led to rupture. Dubreuhl relates ('Lyon Médical,' 1871) a case where the uterus burst aloug its whole anterior wall from eucephaloid degeneration. In the museums of St. George's and Guy's Hospitals may be seen specimeus of fatal rupture from a similar condition. No doubt such specimens may also be found in other museums. But a cancerous cervix may dilate without rupture.

Rigidity of the cervix from cicatricial tissue may also lead

to rupture.

A fibroid tumour in the wall of the uterus has caused rupture. There is a specimen illustrating this in the Middlesex Hospital museum. In a case Robert Barues examined with

¹ Ueber Ruptur der Gebärmutter und ihre Mechanik., Ludwig Bandl, 1875.

reference to a charge of malapraxis, a tumour in the anterior wall of the uterus had got jammed between the head and pelvis, causing perforation of the uterus and bladder. A fibroid tumour may also cause rupture by giving an undue fixed point upon which the normal contracting tissue pulls. But rupture is by no means common in this complication.

A stone in the bladder has caused rupture of the uterus. Guillemeau relates a case; vesico-vaginal fistula resulted. In a case seen by ourselves the issue was fatal.

The cicatrix resulting from Cæsarian section has in several instances given way under the strain of labour. Winckel relates two cases.

Extreme thinness has been observed. It may be general or limited to a part. If, as is likely, this thinning be in the lower segment, rupture at this part is very likely to occur. The lower segment, from its peculiar structure, its function of lodging the head, and its having to bear the chief impact of the driving or distending force, is more disposed to thinning and to yield. But apparent thinness may also occur at the fundus, more especially at the presumed origin of a Fallopian tube. In some of these cases there can hardly be a doubt that there was gestation in one horn of an imperfectly developed uterus. Examples of this are given in Robert Barnes's 'Diseases of Women.' But thinning may be the result of disease, as in a case related by E. Whittle ('Liverpool Med. and Surg. Reports'). The child had passed through a rent near the junction of the body and neck anteriorly. For two or three inches on either side of the rent the uterus was thin and soft. The woman was affected by secondary syphilis, and Whittle believed the degeneration and atrophy were due to this condition. Collins relates a marked case of the kind. Murphy thought 'thinning or partial atrophy not an unfrequent cause.' It is highly probable that this thinning was not atrophic or pathological, but simply the thinning from stretching under the forces of labour, as Bandl and others explain it.

Bandl's theory is that the essential condition is thinning of the cervix. This takes place during labour. Rupture is comparatively rare in primiparæ in whom the muscular walls of the fundus and body are less developed; whereas rupture is frequent in pluriparæ in whom the muscular walls are thicker

and stronger. A strong organ, he says, more easily tears its neck than does a weak one. The uterus can, when sound and strong enough, and works long enough, spontaneously tear its normal cervix, when this has been thinned to a certain degree during labour.

C. v. Braun, Grenser, and others, show that the cervix may be thinned to two lines only whilst the walls of the fundus and body are increased in thickness and strength. Bandl, in his thirteen cases, always found the rupture in the cervix. Thus Bandl's observations confirm the theory we have enunciated

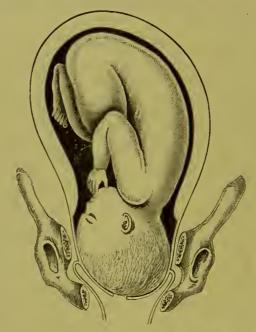


Fig. 46.- Showing Thinning of the Lower Segment of the Uterus (Bandl).

—that rupture ensues from preponderating force exerted upon structures that will not dilate (see Bandl's fig. 46).

Ergot.—In a very large proportion of cases, rupture has occurred after giving ergot. The violent tetanic unintermitting contractions set up must throw enormous strain upon the cervix or the uterus fixed in the pelvic brim. Unless the obstruction be removed by dilatation, it is only too likely that rupture will take place. We have long contended that ergot ought not to be given during labour, since we cannot always be sure that obstruction may not arise.

In the most frequent order of cases, there is no fixing of

the lower segment of the uterus, but the cervix rends, beginning at the edge of the os. In almost every labour this takes place to some extent, and the trace is found in the cicatrices and fissures of the os commonly scen in women who have borne children. If the os be at all rigid, the head large, if the liquor amnii have escaped early, if the os have been carried down very low, and if the pains be severe—especially if stimulated by ergot—an initiatory rent of this ordinary kind may easily extend upwards into the uterus and downwards into the vagina. In these cases the rent is longitudinal and usually to one side. Dubois observes that the habitual direction of the uterine neck to the left, and the left occipital position of the child, account for the greater frequency of lacerations in the left side.

Bandl figures a specimen in which the cervix is nearly 5" long. Thus is seen how deep spontaneous rents of the cervical portion reach. One rent went the whole length of the cervical mucous membrane, the whole thickness of the vaginal-portion, and extended above the insertion-spot of the vagina in the tissue of the uterus. When such rents remain gaping, the cervix afterwards is wanting in the supporting ring; the plurigravida has then no closing os externum, and at the end of gestation and beginning of labour there is only a very short cervical wall.

Alteration of tissue produced during labour is a factor which cannot be doubted. Where the lower segment of the uterus is long compressed between the pelvis and the child's head, the circulation gets stopped; intense congestion of the parts above and below the compressed ring ensues. The part compressed becomes softened, friable, and may yield. If delivery be effected before actual rent, we see the effect of pressure at a later period in sloughing, forming vesico-vaginal fistula, and perhaps even gangrene.

The points at which this bruising or rubbing-through (Usur, Durchreibung) of the uterus is liable to occur are chiefly those opposite the promontory of the sacrum (see fig. 47) and the symphysis pubis. The pectincal ridge may be sharp enough to cut through the uterine wall; sometimes the pubic portion of this ridge, folded back as in ostcomalacia, gives points of resistance against which the head may be jammed. Unnatural sharpness of the edge of the pelvic brim or spinous projections—the acanthopelys of Kilian—are even more dangerous than

simple narrowing. Unhappily the two conditions are sometimes combined, as in a specimen in St. Thomas's Hospital from a case seen by Robert Barnes. Duparcque cites a case in which 'the inferior part of the neck of the womb separated from one side to the other, and the child passed through into the abdomen. The pelvis was a little narrow; the point of the sacrum passed through the posterior part of the womb. The inner and prominent edge of the pubes and iliac resembled an ivory paper-knife.'



Fig. 47.—Transverse or Semi-circular Grinding-through of the Uterus.

In deformed pelves there is often found at the joints an excrescence of bone projecting inwards, so that, when the fœtus presses against the pelvic ring, laceration easily occurs. We have verified this condition. Hence, in all examinations of contracted pelves, the finger should be carefully swept all round the brim when taking note of the kind and degree of the deformity. This bony excrescence is common at the pubic symphysis, and is especially dangerous; it is also found at the sacro-iliac joints. The direction of the lesion in these cases

is usually transverse, corresponding to the direction of the pelvic brim.

Dr. Hofmeier relates a singular case of a bony, beak-like projection from a synostosis of the last lumbar and upper sacral vertebra. This had penetrated Douglas's pouch, as verified by autopsy.

Luceration or rupture from obstruction to labour.— Obstruction to labour is the most familiar immediate cause of lesion of the uterus. Frequently obstruction is complicated with one or other of the conditions described above. It is not necessary to do more than refer to the ordinary causes of obstructed labour. These will be found described under the head of 'Dystocia.' It is enough in this connection to mention narrowing and distortion of the pelvis, tumours blocking the pelvis, rigidity or other diseased conditions of the cervix or vagina, obliquity of the uterus, excessive size of the child, hydrocephalus, monsters, a dead child, locking of twins, and malpositions, producing a wedge, the base of which is too large to enter the brim or to traverse the pelvic canal.

The mechanism or process of rupture or laceration from obstruction may be described as follows:—

When the uterus gives way under obstruction, the liquor amnii has almost always been discharged. The uterus has contracted upon the child. There is no longer the equably diffused hydrostatic pressure. The necessary condition now is that some part of the uterus be fixed, whilst the rest of the organ is pulling from that fixed point. It is this point which generally gives way. Duparcque says, 'Uterine contractions alone are the most frequent causes of transverse ruptures of the neck.' A muscle in active contraction will rarely tear its own contracting fibres. It tears at its attachments, or at the point it is pulling upon, just as the tendo Achillis gives way rather than the muscles which pull upon it. If a muscle is not strong enough to accomplish the object for which it contracts, it becomes fatigued and relaxes. This commonly happens with the uterus, and thus it is saved from rupture. It is only when a sudden increased strain or injury is inflicted at the moment of contraction that the muscular fibres are liable to be torn. The uterus is no exception to this law. We see how it acts in ordinary

¹ Zeitschr. f. Geburtsh. u. Gynäkol. 1884.

labour. It contracts in the direction of its long axis, tending to shorten itself, pulling the os towards the fundus. So acting, the uterus is partly pulled open, partly dilated by the pressure of the bag of membranes or of the protruding part of the fœtus. The effect of the hydrostatic pressure in dilating the cervix in healthy labour is marked. If it fail through too early discharge of the liquor amnii, and there be obstruction, so that the fœtus is slow in engaging in the cervix and in descending into the pelvis, dilatation is slow, and is ultimately effected by the continuous pulling-up of the cervix by the action of the longitudinal uterine muscles. In either case, so long as the cervix—the part pulled upon or stretched—yields, there is no fear of laceration. But if the cervix will not dilate, and the uterus continue to contract, the fætus being driven down violently upon the cervix, the uterus will most likely lacerate here. In such a case the laceration usually begins at the edge of the os uteri and extends upwards longitudinally. Or if the fœtus be dead, or the presentation be abdominal, so that it cannot traverse the os, a limb —as a knec or elbow—forming an angular projection at some part of the body of the uterus, may render this particular part the fixed point upon which the uterine muscles pull; and this point, gradually softening and weakening, gives way. In this case the rent may be longitudinal or transverse, and at any part of the uterine wall. But the direction of the rent is usually determined by the drag of the muscular fibres. Hence, if the rent occur in the sides of the uterus, the rent is longitudinal; if at the lower segment, it is usually transverse.

Collins says that, in thirty-four cases, twenty-three were labours with boys; and McKeever's cases give fifteen boys out of twenty cases.

A similar explanation holds in the greater number of cases of rupture from contraction of the pelvis. The proneness to rupture is not in proportion to the degree of pelvic contraction. If the contraction at the brim be so great that the fœtus and inferior segment of the uterus cannot enter, the risk of laceration is less than when there is just that degree of contraction which permits of the descent of the head into the pelvic cavity, but impedes its further progress. This point was well made out by Radford ('Obstetrical Transactions,' 1867) and others. In nine cases out of eighteen reported by Radford there was slight

contraction only of the brim. Bandl gives evidence to the same effect. In these cases, when the head is forced down, the uterine neck and vagina become fixed between the head and pelvic walls. The uterine muscles continuing to contract, and not being able to propel the fœtus, pulling upon the tissues forming the fixed ring, this will either tear directly, or, being first contused and softened, yields. Hence it is that in these cases the rent is usually transverse or circular, and at the lower segment (see fig. 47).

Bandl points out how such a degree of pelvic contraction as to cause pendulous belly predisposes to rupture. The strong tension put upon the posterior wall of the cervix thins out this part especially, so that it the more readily tears.

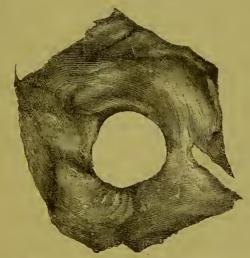


Fig. 48.—Annular Separation of the Cervix Uteri.

Huber (quoted by Fromont and Hegar) relates a case of a pluripara who died ten hours after labour and vain attempts to detach the placenta by hand. These had caused intense pain and convulsions. Effusion of blood was found in the abdomen. In the fundus uteri was a spot the size of a five-franc piece, much thickened. From the centre of this spot a band of cellular tissue and varicose vessels stretched to the peritoneum, which was adherent to the musculus transversalis. At the thickened part of the uterus were several rents a quarter of an inch long, from which the blood had escaped. To the inner surface of this spot the placenta adhered so fast that it could be detached only by the help of a knife.

Annular laceration of the cervix.—In some instances, even where there may have been no pelvie contraction, but the os has been rigid, the cervix has been torn through all round, or has gradually sloughed off and been cast as a ring (see fig. 48).

Cases are recorded by Steidele, Scott, of Norwich, E. Kennedy, Dr. Power, Churchill, Ed. Rigby ('Midwifery,' 1844), Dr. Herbert Barker ('Obstetr. Trans.' vol. ii.). Gervis relates a case ('St. Thomas's Hosp. Rep.' 1872) in which ring-form detachment was not quite complete. It was replaced without sutures, as the subject was very prostrate. She recovered, and the ring re-united. Another case was referred to Robert Barnes by Dr. Hague. In these cases the peritoneum is not necessarily involved, and the danger is not great.

But where the lower segment of the uterus is nipped in the ring of the pelvie brim, the rent commonly involves all the tissues, at least in some part of the circumference. We thus have a direct opening into the peritoneum, through which the child may pass out of the uterus.

Braxton Hicks relates a case of rupture from adhesion of the uterus. No symptoms except pain occurred up to the 8th month, when a slight slip led to a sudden yielding of the adhesion-bands and to a laceration of the uterus, the rupture ultimately extending through the uterine wall, the child escaping into the peritoneal eavity.

Circular laceration or separation of uterus from vagina. —In one class of eases the head enters the pelvis and becomes impacted; a zone of vagina is nipped. The uterus continuing to act, a circular laceration is produced in the manner described. Duparcque shows how it occurs. Once begun, these ruptures may, by the continuing or renewal of the uterine contractions, separate the uterus from the vagina almost completely. Velpean met with this state twice ('Tocologie,' 2ème ed. t. ii.). But the foreeps or hand had been used. The following quotation is very appropriate to the text:—'It will be easily understood how the lifting up of the uterus by ill-directed efforts—as when the woman throws up her belly by suddenly throwing the trunk back, by vomiting or convulsions-may determine a vaginal rupture which was only imminent. Abdominal compression so directed as to lift up the womb when the dilatation of the orifice is complete may, in the same manner, provoke rupture of the vagina. The same thing may happen from pushing back the

child, as this act adds to the state of tension the canal is already suffering; and this is not one of the least common causes of rupture of this kind.'

In transverse vaginal ruptures the head rarely escapes into the abdominal cavity; but the body may easily do so, since the uterus, after rupture, is drawn up away from the child. When the whole child goes into the abdomen, it may be because the head has been pushed back by manipulation.

Several cases of complete circular laceration and separation of uterus from vagina are recorded. We ourselves have known two. Ingleby, Collins, Moulin, and Elkington relate cases. It has been objected to the hypothesis of spontaneous complete laceration that the uterus could not rend its own ligaments. But Casper shows that, during inversion, the round and broad ligaments have been torn. In women who have borne many children, all of whose tissues are degraded, the ligaments at the time of labour are not eapable of much resistance. When the vagina has given way, the whole strain will fall upon them. A little accidental force—as introducing the hand to remove the placenta, the application of the forceps, vomiting—might easily complete the detachment. The late Thomas Paget, of Leieester, published ('Brit. Med. Journ.' 1861) a striking case. A pluripara had a not severe labour of three hours. The placenta was extracted, with but little traction, in twenty minutes. To this, however, was attached a large fibrous mass, which was found to be the uterus with fallopian tubes and ovaries. The vaginal portion hung loose, and was jagged by laceration. She died in forty-five minutes. It was the decided opinion of Mr. Paget that the accident occurred spontaneously.

The following passage from Braxton Hicks ('The Tension of the Abdomen'—'Trans. of Med. Soc. of London, 1884') is of special interest in this connection:—'The pressure of the intestines is not merely to assist in expelling the uterine contents. It has a conservative effect in preventing what may be called the recoil of the uterus. When the head has passed through the os uteri, but has become arrested by some obstacle in front, and the force of the uterine contractions is expended on the upper vagina and lower uterus, and probably the round ligament, the support given by the action of the abdominal walls through the intestines counteracts the excessive strain, thereby lessening the chances of laceration of

vagina. When this support is not given, or is weakened, separation of the uterus from the vagina may be expected if the uterus possesses much vigour, and may be especially anticipated in women whose abdominal parietes are very lax and vaginal tissues weakened.'

Although complete separation may occur spontaneously, a transverse laceration of the vagina near the uterus having once begun, very moderate force may cause it to extend. Denman calls attention to this: 'I was called,' he says, 'to a case in which that part where the uterus and vagina are united was ruptured; the child remaining in the cavity of the uterus, the os uteri little dilated.' He advised not to deliver, because so much force would be required for dilating that it was feared the uterus would be completely torn from the vagina before the hand could be passed into the uterus, at least before the child could be extracted, 'and then the case would have been more horrible.' The woman would, in all probability, have had a better chance had she been in the hands of a bolder man, who would have done what Denman dared not to do. But he would have done it at the risk of his own reputation, and of a conviction for manslaughter, with imprisonment as a felon!

Dr. Jamieson relates ('Edinb. Med. Journ.' 1872) the case of a woman whose spine was short, so that the last ribs squatted below the iliac crests. There was great anteversion of the uterus, which therefore acted at great disadvantage. Continuing to contract violently, it tore itself away from the vaginal attachments.

It may seem surprising that the uterus should thus retain power to tear itself apart from its attachments. It might be expected to be paralysed from the cutting off of its connections with the nervous centres. What these cases prove is that the uterus has in itself an inherent contractile force, which enables it to act for a time independently of the nervous centres. In this respect it resembles the heart, which will beat for some time after removal from the body.

There are specimens illustrative of circular separation in St. Bartholomew's Museum. 'Nos. 32-46.—Uterus and vagina. During parturition the vagina was torn through half its circumference, close to the part connected with the uterus. Nos. 32-47.—Uterus, the neck of which was torn through two-thirds of its circumference during parturition. The child was hydrocephalic.'

The argument that the uterus ruptures itself is enforced by Roberton, who draws the conclusion that, in the majority of these instances of rupture caused by faultiness in the pelvic brim, the accident occurs within twelve hours after labour has commenced. This implies unimpaired vigour of the contractile force.

Complete separation of the uterus is not necessarily fatal. Ingleby relates a case which occurred to Mr. Cook, of Coventry. The separation took place the second day after delivery; and the specimen, which embraces the uterus in a state of *inversion*, together with its ligaments, has been deposited in the Birmingham Museum. Weisberg relates a case in which the uterus was removed for inversion immediately after labour. The woman recovered. In connection with this possibility of recovery, we may now refer to the numerous cases of recovery after removal of the gravid uterus by Porro's operation.

Avulsion.—The uterus may be torn away after delivery of the child. One lip of the os uteri—generally the anterior one—may hang down in a flap, large and loose, even protruding through the vulva. This has been mistaken for the placenta or clot, supposed to be adherent. We have recently seen a case of this protrusion, in which pulling upon the protruding part was narrowly avoided. Duparcque relates a case in which this error occurred, the part pulled upon being actually torn away.

Dr. Walters ('Obstetr. Trans.' 1883) exhibited a utcrus that had been torn away by a midwife in the attempt to remove a retained placenta. The uterus was well contracted and empty, the placenta having been expelled during the manipulations. A piece of omentum about twelve inches long had been prolapsed, and was also removed. The woman made an excellent recovery. One ovary had come with the uterus; the other remained. In an extended memoir on the subject (to appear in the next volume of the 'Obstetrical Transactions'), Mr. Walters has endeavoured to collect all the known cases of avulsion. He refers to fifteen cases of recovery.

Spiegelberg relates a case in which a practitioner, trying to bring on labour on account of convulsions, passed his fingers up the urethra, lacerated the base of the bladder and the urethra. The woman died undelivered in a few hours.

Entire separation by sphacelus completed after labour.—

Cases of this nature must be distinguished from those by laceration above described. Dr. More Madden relates an instructive case. A primipara, aged 33, was admitted into the Dublin Lying-in Hospital, having been eight hours in labour; the os was about the size of a shilling, and the head low down in the pelvis, pressing on the cervix uteri. The pains in the second stage were weak. A stimulating enema and ergot having been tried, she was delivered under chloroform by forceps. No force was required; a child weighing 6 lbs. was born alive in two minutes. She became suddenly collapsed, and died. Autopsy revealed advanced peritonitis. The uterus was intensely inflamed in the cervical portion, which was actually in a state of sphacelus. The ulceration had extended completely through the cervix, so as to have entirely separated the uterus from the vagina. The line of separation was as sharp and clear as if effected by the knife. The vagina was-particularly near the vulva-in a state of intense inflammation, and had sloughed considerably on its anterior wall.

In many cases where rupture has been observed in the body of the uterus, it probably extended from the cervix. Collins, Clarke, and Bandl never saw rupture at the fundus; and there is reason to donbt whether some cases reported as such were not really examples of the giving way of the sac of a mural gestation, or of the horn of a one-sided uterus.

Tyler Smith insisted that lacerations may be caused by the irritation of manual examination. Several cases lend confirmation to this view. In one case recorded by Robert Barnes ('St. Thomas's Hospital Reports,' 1870), 'when examined, the uterus was felt contracting; the os uteri was not reached, but the head was just felt through the anterior segment. Whilst under examination the pains stopped; the woman said she felt something give way. She walked across the room after this, but collapse followed in five minutes.' We may, then, admit that rupture may be caused through the excito-motory system. But the centric stimulus to inordinate uterine action is frequent. In a very large number of cases ergot had been given. It is to be remembered that, as in other orders of cases, so it is in this, the action of the uterus is excessive and suddenly evoked, and probably disorderly in character; in this respect resembling

¹ Brit. Med. Journ. 1874.

those which occur before labour, in the circumstance that there is no adequate safety-valve process of cervical dilatation to meet the sudden contraction of the body of the uterus upon its incompressible contents.

Rupture has on many occasions taken place or been extended during straining at stool. We have witnessed an example.

Lacerations of the vaginal-portion do not always extend through the peritoneum. At the lower segment, posteriorly, the connection of the peritoneum is looser. Rent beginning at the mucous surface, and involving the fibro-muscular tissue, may terminate by stretching the connective tissue, so that the peritoneum is dissected off from the utero-vaginal surface. Another condition favouring this escape of the peritoneum is the great distensibility of this membrane. Blood is effused, as we have seen in the description of 'thrombus,' in this tissue, forming peri-metric hematocele. The peritoneum is, in fact, undermined by the effused blood. It cannot be rare, since Collins observes that, in nine out of his thirty-four cases, the peritoneal covering did not give way. 'Yet,' he adds, 'death ensued equally speedily, showing that the free admission of air into the abdominal cavity is not attended by any increase of danger.'

The part where the blood is effused forms a bulging on the outer surface of the uterus, and the peritoneum may crack. This variety is sometimes ealled 'partial rupture.' When moderate in extent, the injury and shock are commonly much less severe than in complete ruptures. External hæmorrhage usually attends. The collapse and ominous change of countenance, the sensation as if something had snapped, characteristic of complete rupture, may be wanting. Hecker has drawn attention to a sign depending on the extra-peritoneal thrombus. The pulse, he says, always falls; even at the beginning of the rupture it is quick and small. Then a hematocele forms in the connective tissue between the neek of the uterus and the bladder. The swelling thus formed is smooth, elastic, and quickly-growing. These rents differ from rents in the body of the uterus in that they do not readily close; they remain gaping.

Another form of incomplete rupture is that in which the peritoneal coat is alone or chiefly torn. Over the body of the

¹ Monatsschr. für Geburtsh. 1868.

uterus the connection of the scrous membrane with the muscular wall is so intimate that it is scarcely possible for rent of the peritoneum to take place without involving the muscular wall to a slight extent. When it occurs, some blood is often effused into the peritoneal cavity. Jacquemicr describes splits and scars in the neighbourhood of the fallopian tubes and round ligaments, the result of mechanical distension. These, say Dubois and Pajot, do not appear to give rise to perceptible symptoms. They may be likened to the lesions of the skin from distension of the abdominal walls. But in the more severe cases of peritoneal laceration death may occur from shock, as in a case narrated by Clarke ('Trans. of the Soc. for Improvement of Med. and Surg. Knowledge'), where only an ounce of blood was found in the abdomen. Collins relates a similar case. It is probable that in such cases the lesion of the peritoneum was not the principal injury, but that it was rather an indication of severe sudden distension of the muscular coat.

A more frequent cause of death seems to be hæmorrhage, as in cases recorded by Ramsbotham and White.

There is a good specimen of peritoneal rupture in St. George's Museum.

Lacerations of the vagina have been carcfully described by McClintock ('Dublin Quarterly Journ. of Med.' 1868) and by Scanzoni. There are incomplete lacerations. Tearing of the mucous membrane alone may happen, and is frequent. The submucous tissue may tear and give rise to thrombus, as already described. Circular laceration of the upper zone of the vagina has been described. Spontaneous lacerations of the upper part of the vagina are often the result of extension of laceration of the lower segment of the uterus. The peritoneum behind, or the bladder in front, may be involved.

We have already seen that, when a rent has begun in the upper zone of the vagina, it may easily extend under uterine contraction or manipulation. And we must also bear in mind that transverse rupture of the posterior wall of the vagina has been caused by the sheer force of the expulsive efforts driving an ovarian tumour upon it, or the retroverted uterus in early pregnancy (E. Martin, Dubois, Schnakenberg, Grenser), and the non-pregnant uterus (Fehling), or an extra-uterine gestation-cyst (Thormann).

Rupture of the middle part of the vagina is rare. It can scarcely take place through its own contractions, since its contractile power is greatly diminished by distension during labour. It commonly occurs when the head is in the pelvis; and is therefore probably caused by the action of the uterus, either dragging the canal upwards from the impacted head or driving the head through the distended walls, as we have seen that an ovarian tumour or the gravid uterus may be driven through by the abdominal expulsive efforts. A dead, flaccid child would favour this accident, or a face-presentation, or an occipito-posterior position, in all of which there is a tendency to delay in labour, and to rolling back of the head in extension, thus stretching and bruising inordinately the posterior wall of the vagina.

Vaginal lacerations mostly take a circular form. They remain patulous. And if the posterior wall is torn, the escape of the fœtus into the peritoneal cavity is frequent. Prolapse of the intestine is not uncommon.

Sloughing of the vagina may follow from the crushing and necrosis of the vagina under severe protracted labour with disproportion, whether instruments have been employed or not. Injury of this kind might almost always be averted, did the opportunity offer of reducing the bulk of the child in time. Sloughing may terminate in gradual cicatricial closure of the vagina. It is actually obliterated, perhaps a minute sinus alone remaining to communicate with the uterus. In such a case menstruation may be carried on, and conception may take place. But when the obliteration is complete, if menstrual activity be renewed, there will be retention above the cicatricial septum, and symptoms similar to those of retention from imperforate hymen arise. We have relieved such cases by operation.

Sometimes the sloughing and consequent cicatrix involve the cervix uteri as well as the vagina.

The treatment during the sloughing stage consists in copious disinfecting irrigations, and in counteracting the cicatricial contraction by wearing a Sims's dilator or other form of vaginal-rest or pessary.

Laceration of the inferior third of the vagina always takes place in the posterior wall, and merges in laceration of the perinæum. It is, in fact, a giving way of the pelvic floor or the lower or posterior valve of the parturient canal, which, in

the expulsive stage, bears the chief strain of labour. This laceration may be central and perforative or vulvo-vaginal. In a considerable proportion of cases we believe the rent begins in the centre of the perinæum, then extends backwards and upwards into the recto-vaginal septum, and forwards through the commissure. In almost every first labour more or less laceration of the commissure or fourchette takes place. This is usually insignificant; but it is not unusual to find lacerations an inch in length, or extending back to the edge of the sphincter ani. As the parts recover from distension, these lacerations are reduced, and granulation often substantially repairs the injury. Occasionally, in spite of every care, the rent extends through the sphincter. In lingering labour the expansibility of the parts becomes impaired. Under the congestion and long compression the circulation becomes impeded, and, after a time, the tissue, half-necrosed, becomes brittle as wet brown paper, yielding under the slightest force. Timely used, the forceps may, by anticipating this change of structure, and by giving a proper forward direction to the head, save the perinæum. But, on the other hand, whether skilfully used or not, the forceps may cause laccration.

Rupture of the perinaum, whether it occur under spontaneous or instrumental delivery, is not evidence of want of skill. Under instrumental delivery, which presupposes unusual difficulty, rent is à fortiori more probable. This is important to remember, because threats of legal proceedings to extort money have been based upon accidents of this kind.

Sometimes the rupture is limited to the central perforation. Duparcque measured the periuæum as distended by the head. The length was 3.50 in. to 4.10 in., the breadth 6.00 in., being much more than its ordinary dimensions. It is, moreover, excessively thiuned. If the head be large, firm, the perinæum at all rigid, and especially if the coccyx retreat much backwards, or the pubic arch be narrow so as to oppose extension of the head round the symphysis, the perinæum becomes enormously distended centrally, and is very apt to be perforated. The child has been driven through this perinæal opening, the commissure being preserved intact; but more frequently the rent forwards is completed. The structures may also give way under stormy, tetanic contractions. We have seen a fistulous hole in the

perinæum remain after perforation. Lamb relates a case ('Amer. Journ. of Med. Sc.' 1856). The wound healed. Schmitt-Müller another ('Bayer ärztl. Intell-Blatt,' 1865). The opening was closed by sutures; after suppuration it healed. Jarjavay¹ quotes from Jobert de Lamballe (1850) the history of a labour complicated with ovarian tumour. The head was kept back by the tumour; during labour the tumour was driven through the rectum and perinæum. Luschka also reports ('Monatsschr. f. Geburtsh.' 1867) a case of an ovarian tumour which was driven out of the vagina.

Rent frequently begins at the vulvar edge from extreme rigidity. This may be prevented by timely incisions. Laceration may take place at the anterior edge of the vulva. Tyler Smith affirms this, quoting Robert Barnes's statement (1858). P. Müller ('Scanzoni's Beiträge,' 1870) also describes this injury. In one case fatal hæmorrhage ensued.

B. Hicks points out that the passage of the child's head in primipare will occasionally push before it the internal membrane of the perinæum, so as to tear it, leaving a raw surface difficult to heal. On this Emmet² makes a similar statement. 'The perinæum is frequently torn on the vaginal surface, without the fissure extending to the skin; . . . a fold of vaginal tissue is pushed forward by the child's head. This laceration is deep enough to divide the central attachment of the ischio-perinæal ligaments and leave the vaginal outlet flaccid.' The prophylactic treatment turns chiefly upon the question of 'supporting the perinæum.' For the discussion of this we refer to the chapter on 'The Management of Labour.' One point may be repeated: 'Support' should not be given until the head is undergoing extension.

The analogy between rupture of the perinæum and rupture of the cervix uteri—that is, of the anterior and of the posterior valve of the parturient canal—is striking. We may, by observing and studying the mechanism of rupture of the perinæum—a phenomenon which takes place under the eye and touch—arrive at instructive conclusions as to the mechanism of rupture of the uterus. The perinæum certainly ruptures without being diseased. The presumption is that the healthy uterus may do the same.

¹ Traité d'Anatomie Chir. vol. ii. ² Principles and Practice of Gynacology. VOL. II.

What to do when laceration of the perinaum occurs. This depends upon the degree of the laceration. The slighter rents commonly heal sufficiently if left alone. But there is a very potent reason for not leaving them quite alone. The raw surface may be a gate for the entry of septic matter into the system. It must, therefore, if not closed, be kept sweet and disinfected. This is best done by placing a pledget of lint soaked in a solution of chloride of sodium or carbolic acid between the edges of the wound, taking care to press the lint well into the fork of the wound. And when the perinaum has been injured, it is desirable to cleanse the uterus and vagina by disinfecting injections.

When the rent has extended partly or wholly through the sphincter, healing may still take place spontaneously. But, if the patient's condition admit, it is better not to rely upon this prospect. Immediate reunion by suture should be practised. The recent tear seems as favourable to union by the first intention as a fresh raw surface made by the knife. And under anæsthesia the operation is not difficult. If the operation be not done within twenty-four hours, it will generally be wise to postpone it until after recovery from puerpery.

Dr. Jenks makes an important practical distinction. He found these wounds heal well after suture when the rent was quickly made through sound tissue; but union failed if the rent had occurred after long protracted labour, causing brittleness of the tissues.

During pregnancy, especially in the early months, wounds of the vagina and uterus are frequently the result of attempts to procure abortion. Various stilets or pointed instruments have been used. If unskilfully used, as is often the case, puncture or laceration of the vagina or cervix uteri often occurs in the attempt to pass the os. In other cases, punctures have been found penetrating the cervix and the wall of the uterus, opening into the peritoneal cavity. In these cases, effusion into the peritoneum may end in death. In minor injury, perimetritis and pelvic peritonitis of an acute type are very common, and may also be fatal. The symptoms of abortion commonly, but not necessarily, attend.

Traumatic injuries inflicted from without. These may result from violence inflicted through the abdominal wall or

through the vagina or rectum. Injuries inflicted through the abdominal wall are of endless diversity.

The injuries inflicted through the vagina or rectum are of more special obstetric interest. These may arise from the use of the hand or of instruments. How force exerted by the hand may cause extension of laceration already begun has been described. In cases where the structures are still intact, the hand, unskilfully used, may begin a laceration. This is more especially likely to occur in attempts to turn when the parturient canal is blocked or narrowed by an impacted fœtus. If the labour with impacted fœtus have been long protracted, the soft parts become brittle or friable from obstruction to the circulation, and then moderate force, even skilfully employed, may easily result in laceration. The hand may also inflict injury in attempts to force it through the cervix to detach a prævious placenta, or to remove a placenta after the birth of the child.

Injuries inflicted during labour may or may not be a consequence of unskilful obstetric manœuvres. Not seldom it is very difficult to determine, even in the presence of the most severe and extraordinary injuries, whether accident—avoidable or unavoidable—or direct violence was the cause. They may have begun spontaneously, and have been extended by attempts, perfectly legitimate, and perhaps not unskilful, to complete delivery of the child or placenta, or to return prolapsed intesine. It requires the greatest circumspection not to commit oneself to an opinion which subsequent evidence may prove o be erroneous. It must sometimes be impossible to discover n the wound itself unequivocal proofs as to the mode of its ormation.

Chiara says that in three years he verified 11 ruptures of he vagina, uterus, or uterine peritoneum; 7 of these were roduced by attempts to turn when the shoulder was deeply redged, and 4 under conditions not so unfavourable, and in the lands of operators whose skill could not be questioned.

Subperitoneal emphysema is sometimes observed in conection with rupture. Kiwisch and McClintock have noted it. t occurs chiefly in the lower segment, in front, and in the left iac region. It may arise from air entering during intra-vaginal anipulation, or from decomposition of the embryo. Duncan values it by the renewed 'retentive power of the abdomen' when contraction of the uterus and bearing-down force of the abdominal muscles intermit. A kind of suction-force succeeds. Bayer 1 describes a remarkable case. The air penetrated along the psoas major muscle up to the right kidney where the extravasation had become converted into foul pus and gas. He says Hecker, Dohrn, and Löhlein have related cases.

Wounds of the perinaum.—Severe injury of this part, if noticed before the descent of the head, is most probably the result of external violence. If known to have occurred during the delivery of the child, it would be difficult to prove that it was due to criminal malapraxis, however strong the suspicion might be that it was due to unskilful treatment.

Injuries of the vagina mostly occur at the upper part. They may arise from the unskilful use of the forceps or perforator. The blade of the forceps may be forced through the roof of the vagina, and may thus penetrate into the peritoneal cavity and partially detach the uterus from the vagina. Wounds made in this way are almost always transverse; but so are most of the laccrations of this region which occur under the natural forces. Possibly the edges of the wound may show marks of bruising by the forceps.

The roof of the vagina has been pierced by the perforator. This accident is not so utterly inexcusable as may be supposed. A very projecting sacral promontory, occupying as it does exactly the place where the head ought to be, and presenting physical characters very similar to the touch, may easily deceive the inexperienced. Strict observance of the rules hereafter given for the use of the forceps and perforator will enable the operator to avoid these calamities. We believe the accident has happened from the use of bad instruments. Indeed, it must require an amount of skill beyond the average so to use some of the vile instruments still in vogue as to avoid their slipping and doing mischief under some circumstances of difficulty.

The crotchet may slip and tear the uterine wall, especially near the cervix. Jagged pieces of cranial bone detached by the crotchet may inflict similar mischief. The obvious way of avoiding these accidents is to discard the crotchet, and to substitute the craniotomy-forceps or cephalotribe. These instruments are far more effective, as well as safer.

¹ Archiv. f. Gynäk., xxi.

Laceration of the uterus or vagina may take place in the attempt to detach an adherent placenta. This is the more likely to happen when the uterine tissue is diseased. The operation should be done with great gentleness. It is better to leave portions adherent than to persist too strenuously in tearing them off. Mr. Dunn relates 1 a case in which rupture occurred with an adherent placenta. There is a preparation in University College Museum showing the same combination. This subject is considered under 'Hæmorrhage' and 'Diseases of the Placenta' (see Vol. I. p. 585).

The first danger in turning is encountered in the endeavour to get the hand past the presenting part of the child. If this be roughly done, the uterus may be partially torn from the vagina. If this danger be overcome, the uterus may be perforated in its body by the projection of the knuckles or by violent thrusting forwards of the fingers. These dangers are avoided by decapitation or other modes of bisecting the child. Upon this subject Denman says: 'If the uterus be strongly contracted, it may be ruptured by attempts to pass the hand; but in this case a rupture could only happen when the force with which the hand was introduced was combined with the proper action of the uterus; for the strongest person has not the power to force his hand through a healthy and unacting uterus.' We are not prepared to assent to this; and we must bear in mind that the uterine tissue in the cases postulated is likely to be softened. But we must admit that it is very possible to tear through the vagina, and also to rend the os uteri, whence the lesion may easily extend into the body of the uterus.

Symptoms, Course, and Diagnosis.

The symptoms and course will vary with the cause, extent, and seat of injury. The common signs are those of 'abdominal shock,' indicating severe intra-abdominal injury.

Rupture of the uterus during early pregnancy can hardly be distinguished from rupture of a tubal gestation-cyst. The subjective symptoms will be almost identical. We may arrive at a diagnosis by exploring the uterus with the sound, especially

¹ Obstetrical Trans. 1868.

after dilating the cervix with laminaria-tents. We may thus find the uterus intact, and if its size be not much increased, we have additional evidence that the pregnancy was not uterine. There may be external hæmorrhage in both cases, but this will probably be more abundant in uterine rupture.

The symptoms of spontaneous rupture or laceration early in labour, as commonly described, and as they occur in many instances, are: Sudden acute pain, with a sense of rending in the belly, sometimes attended with an audible snap, it is said: quick collapse, marked by pallor, fainting, extinction of pulse: vomiting; some hæmorrhage externally, and the signs of anemia from greater loss internally; cessation of uterine contraction. If the child be thrust wholly or partly out of the womb, the abdomen flattens somewhat; there is retreat of the presenting part of the child from the os uteri; occasionally prolapse of intestine in the vagina or beyond the vulva; great pain, especially on palpation over the abdomen, where irregular hard projections are felt which may be identified as parts of the fœtus. If the effusion of blood be great, there is increased and distressing tension of the abdominal walls. Cramp-like or spasmodic pains follow. The flushed face becomes suddenly deadly pale; the eyes lose their brilliancy; the whole surface is covered with a clammy sweat; trembling of the limbs or repeated faintings announce a profuse internal hæmorrhage. Presently, when reaction comes, the patient complains of feeling a warm fluid pouring out in the neighbourhood of the groins and loins. She sometimes feels the movements of the child when it has escaped into the abdomen. But usually the child dies quickly.

It has, however, often been observed that the symptoms are not so strongly marked. Sometimes very little is complained of at the time when it was presumed that the injury took place. The collapse creeps on gradually. The woman may be even capable of walking about for some time. Denman reports such a case. We have noted one.

But, sooner or later, almost always within two or three hours, collapse becomes pronounced and pain is severe. The gradual development of the symptoms is explained in some cases by the gradual progress of the injury. The rent does not at one stroke attain its maximum. There is first a moderate rent, possibly not through the peritoneum, and without much

effusion of blood. The rent extends, and blood and, perhaps, the fœtus are extruded. We must not, then, expect uniformity in the symptoms.

In many cases no decisive symptoms precede. It is prudent to look upon the signs of obstructed labour—that is, of dystocia—as the proper premonitory signs of rupture. Obstruction allowed to persist may lead either to rupture or to exhaustion. The following condensed report is full of instruction:—In a case of occlusion of the cervix uteri the pulse rose to 140; crampy, painful contractions of the uterus set in; rupture seemed imminent. Incision of the cervix, allowing expulsion of the feetus, brought almost instant relief.

The symptoms of boring-through under pressure and friction can hardly be distinguished from the extreme collapse and irritative fever which attend upon long-protracted labour. The perforation of the uterine tissue is only the climax, the last stage of long-preceding injury. The symptoms are gradually intensified. The patient dies of prolonged shock, exhaustion, and deteriorated blood.

Hæmorrhage varies greatly in different cases. In some fatal cases scarcely any blood has been lost. This may be partly explained by the rupture having traversed parts distant from the cervix and sides of the uterus and the placental site; from the placenta itself not having been detached; and from the uterus having quickly contracted. There is usually little or no hæmorrhage in the cases of gradual perforation or separation resulting from long compression.

The diagnosis of laceration when the fætus has been extruded into the abdominal cavity is generally distinct. Parts of the child are felt by external palpation. The contour of the abdomen is distorted; it presents irregular prominences. The interus may be felt contracted and shrunk down towards the symphysis pubis. But the most certain sign is obtained by passing the hand into the uterus, where possibly intestine may be felt coming down into its cavity, or even into the vagina, and the hole may be felt. In a case where the rent was anterior, the finger was felt protruded through the rent by the hand on the abdomen.

Where the fœtus is still retained in utero the diagnosis is less obvious. But here also there is generally some recession

of the presenting part. The symptoms also vary according to the seat and degree of the injury. Laceration of the cervix, not extending to the uterus or vagina, may give rise to no marked symptoms. It may be a cause of secondary hæmorrhage.

marked symptoms. It may be a cause of secondary hæmorrhage. The symptoms of laceration of the vagina are usually less severe than where the uterus suffers. Premonitory signs are rare. The shock is moderate; vomiting is not constant; escape of the fœtus and placenta into the peritoneal cavity is more frequent (McClintock) than in uterine rupture. Prolapse of the intestine is not uncommon. But simple laceration, without expulsion of the child into the abdomen or prolapse of the intestine, may be fatal from shock, as in a case communicated to us by John Ray (1875).

The prognosis is in a high degree unfavourable. The successive risks which the subject of rupture of the uterus has to run are:—1. Shock. This may kill in a few hours. 2. Hæmorrhage. This acts more slowly. But shock and hæmorrhage are often combined and act quickly; and secondary hæmorrhage may extinguish life, tottering under the first blow. 3. Metritis, gangrene, parametritis, peritonitis, diffuse suppuration, leading to, 4. Thrombosis and embolism. Psoas abscess was the cause of death in one or more of Collins's cases. 5. Blood-infection, which may prove fatal at variable intervals, extending to days or even weeks. 6. In the perforative injuries there may be sloughing or gangrene, especially where the bladder is also involved. Rokitansky states that the uterine artery has been opened by sloughs in the cervix, giving rise to fatal hæmorrhage. 7. The agglutination from inflammation may obstruct the intestine and cause fatal ileus. 8. When intestine has come through the wound, it may become strangled. It is to be noted that, in several fatal cases, masses of blood decomposing were found in the abdominal cavity.

Cases apparently the most formidable do not exclude hope. Numerous instances are recorded of recovery even after the child extruded into the abdomen has been extracted by turning through the uterus. Some cases have been reported in which recovery followed although the child was left in the abdomen. It may be doubted whether some of these cases were not cases of extra-uterine gestation. On the other hand, it is possible that the child, encapsulated by inflammatory deposits, has been

after a time discharged on disintegration. Recovery where the child is not cast into the abdominal cavity is more frequent. A moderate quantity of blood in the peritoneum may form a hæmatocele, and the uterine wound may heal. Perimetritis in such a case becomes a conservative process; and the uterus may contract adhesions with the abdominal wall. The uterus, contracting, retreats into the pelvis; the wound either closes by a scar or may remain unclosed in part, the opening being shut off from the peritoneal cavity by adhesion to the abdominal wall.

Mortality, as deduced from statistical tables, must necessarily be untrustworthy. Cases that have been subjected to treatment, good and bad, or to none at all, are cast up together. There is, however, as we have seen, ample evidence to prove that recovery has happened even from the severest injuries and complications. This is the all-important point, since upon it we base the hope of successful treatment. There cannot be a reasonable doubt that more lives might have been saved had the cases been treated according to the light of actual knowledge, and especially by laparatomy, the removal of the child, and then of the uterus by Porro's operation. The prognosis in the future is assuredly better than it has been in the past.

The prognosis in laceration of the vagina varies with the seat and extent of the injury. Large lacerations in the upper zone are most dangerous, often fatal. But in rents in the middle zone and in the pelvic floor, especially the latter, there is a fair prospect of recovery. If the rent involve the bladder, the prognosis is more serious.

Rents confined to the vaginal-portion of the cervix, or at least not extending to the os internum, are not often fatal, unless it be by immediate or secondary hæmorrhage, or by favouring septicæmia. When the rent runs up to the vaginal roof so as to trench upon the broad ligament, pelvic cellulitis is, as Emmet has well shown, a very probable consequence.

The treatment.—The prophylactic treatment resolves itself mainly into the management of dystocia. Bearing in mind the cardinal fact that in the vast majority of cases rupture begins at the cervix, whenever we find the cervix unduly tense, not dilating before extreme pressure, when thinned to the utmost and long compressed, we have a strong indication either to

diminish this pressure by lessening the head, or to supplement defective dilatation by incisions in the cervical ring.

The remedial measures will be governed by the nature of the case. To take the first case:—The child, or at least the presenting part, remains in the uterus or vagina. As a general principle, the indication is to deliver. This admitted, the question remains as to the best mode of delivery. To rally the patient from shock, it is wise to administer a drachm of ether by subcutaneous injection, to empty the bladder; and generally anæsthesia should be induced by ether inhalation. If the head present, if the cervix be expanded, and there be no marked obstruction from pelvic deformity or other disproportion, the delivery may be accomplished per vias naturales, by forceps. An assistant should grasp the uterus between both hands during the extraction. When the child is delivered, even greater care is required in the removal of the placenta. The cord must be tracked up to the placenta, and the greatest possible circumspection will be necessary in order not to mistake this body for anything else, and to avoid dragging down intestine along with it. Although the presenting part of the child may not have escaped into the abdomen, the placenta may have done so. The cord then may guide the operator's fingers into the abdominal cavity, where the placenta may be surrounded by floating intestines. The wound has probably retracted, and the return of the placenta through the diminished aperture may be impossible without the exercise of dangerous force. The cord may break off, and the placenta be left loose amongst the intestines. Shall we search for it there, by thrusting the hand through the rent in the uterus? No! There is a better way, which will be presently described.

Take the next case:—Obstruction from disproportion or malposition. It is better to perforate the head and to deliver by craniotomy. If the child present transversely, decapitation or bisection of the trunk is far preferable to turning, which is almost sure to involve extension of the injury. Indeed, looking to the slender chance there is of delivering a live child, it will generally be better to deliver by craniotomy, even when there is no disproportion. The child quickly dies after the shock of the rupture.

The third case :- The child, with or without the placenta,

has been cast into the abdominal cavity. Sometimes the ovum entire has been cast into the abdominal cavity. If the rent be in the vagina, it may not be difficult to remove the child by the hand passed through the rent; and success has several times followed the removal when the rent was in the uterine wall. Ingleby relates a successful case. Danyau, Bell of Bradford, Duparcque, also relate successful cases. On the other hand, the failures to remove the child and placenta by this method are numerous. Success can at best be looked upon as a rare and fortunate accident. Even when child and placenta are removed the operation is imperfect. Clots of blood remain, and more blood is apt to be poured out from the wound. The operation itself is full of danger. The injury may be increased; the shock is intensified. Many women have died under the attempt.

Actual knowledge leads us to consider two other operations as offering a better prospect for the mother, and as giving a chance for the child. These two operations are —(1) laparatomy simple, and (2) laparatomy supplemented by the removal of the uterus—in other words, Porro's operation.

1. Laparatomy simple.—This operation consists in making an abdominal incision from about two inches above the umbilicus down to within three inches of the symphysis pubis, and extending it if necessary. When the abdomen is laid open, the child and placenta are removed and clots cleared away. The peritoneal cavity is sponged out with carbolised water; the uterine cavity is cleaned out in like manner; and if the uterus be well contracted, it may be left to heal by itself. If flaccid, and the wound gape, it may be closed by catgut or silk sutures. We have, in fact, completed a Cæsarian section of which Nature has done half.

The advantages of this operation over extracting by the vagina are manifest. There is little danger of further lacerating or injuring the uterus or vagina; the offending feetus, placenta, and blood are easily and completely removed from the abdominal cavity; the uterine cavity can be cleaned out; haemorrhage from the placental site can be staunched by styptic swabbing; haemorrhage from the torn edges of the uterine wound can be stopped by uniting the wound by sutures. A fair success has attended this operation. In two cases in which we

performed it very sensible immediate relief appeared to be gained; the shock seemed diminished; the pulse recovered tone; and we were satisfied that life was prolonged. In both cases the operation was delayed some hours. When death follows, it may be difficult to assign to the original injury and to the operation their respective shares in the result. But, looking to the history of ovariotomy, to the exploratory incisions made without completing ovariotomy, we are justified in regarding the operation itself as of comparatively small moment. It is the original injury that kills. If we fail to save the woman from her extreme peril, we must find comfort in the reflection that we have done the best that art and humanity suggest.

Porro's operation.—The other alternative, that of proceeding after laparatomy to remove the uterus, includes all the advantages of simple laparatomy with additional security against hæmorrhage, and the special advantage of removing the injured organ, which, if left, might be a source of danger, immediate and remote. It is surely desirable that a woman who has once survived rupture of the uterus should be secured against the possibility of having again to run so great a hazard.

The operation will be found described under the 'Cæsarian Section.'

Dr. Godson collects six cases in which Porro's operation was performed after rupture of the uterus. The mothers all died. But this result cannot rightly be attributed to the operation. In all cases the child was dead before the operation.

The complication with prolapse of intestine—history, diagnosis, and management. Intestine may be protruded by the natural expelling forces, or it may be dragged out accidentally, or through recklessness, or by getting entangled in the limbs of the child. We may next inquire how much and what portions of the intestine can be protruded spontaneously? The histories of cases given are wanting in precision upon these points, but certainly more than six feet may be thus driven out, and we are not justified in denying that very much more may be driven out. The force required to drive out intestine is really very small. The intestines are retained in situ by being packed in a closed bag. The mesentery is not wanted to suspend them; it is a delicate membrane, the chief use of which

is to earry blood-vessels, lymphatics, and nerves. When the bag is opened the intestines easily escape. This is constantly seen in ovariotomy. Any one who has witnessed a post-mortem examination must have been struck with the facility with which the body is disembowelled. Robert Barnes instituted experiments to demonstrate the force required to drag out intestine. The mesentery being detached at one point of the small intestine, a two-pound weight was attached to the coil; it quickly ran down to the ground earrying intestine with it, the mesentery offering but slight resistance. Braxton Hicks and Goodhart subsequently made similar experiments at Guy's Hospital, and obtained similar results. Now, the expulsive force of the abdominal museles must exceed two pounds. It is incontestable that it must equal the weight of the child, for the abdominal muscles alone may expel the ehild and the uterus along with it. An approximate idea of the power of the abdominal muscles, even in a delieate woman, may be obtained when we attempt to grasp the uterus through them to express the placenta. Not seldom, contraction so powerful is excited that the hands of a strong man, using his utmost strength, and putting his weight into the effort, are thrown up from the uterus. In a ease of laparatomy, a solid tumour weighing 28lbs. was thrown out of the abdomen by the mere force of the diaphragm under vomiting. Without insisting upon the experiments and calculations of Dr. Haughton, already referred to, we are satisfied that the expulsive force is not overstated at fifty pounds.

A case related by Fehling ('Areh. f. Gynäk.,' 1874) is a distinct illustration of the simple action of the expiratory muscles in expelling intestine. The subject, a pluripara, aged 63, had suffered from a reducible prolapsus vaginæ for thirty years. Carrying a bucket of water up steep steps the womb came down. She tried to replace it, using some force. She felt something give way, and intestine protruded, forming a mass as large as a man's head. The intestine was traced back into the abdominal eavity through a large rent in the posterior vaginal wall. The woman died in eleven hours from shock. Dr. Fehling informed us that the amount of intestine protruded was probably over twelve feet.

It is eommonly said, and it is indeed sometimes true, that

rupture is quickly followed by paralysis of the uterus. But we must be careful to qualify this statement. The uterus frequently contracts forcibly after the analogous injury inflicted by Cæsarian section; and, as a matter of observation, it also contracts after spontaneous rupture. If it did not contract, how are we to account for the cases of recovery? It is because the uterus contracts that prolapse of the intestines is not more frequent. The uterus, like the heart, has an inherent contractile power. It has been known to contract after being almost entirely separated from its attachments, and even after death. Bandl says he almost always found the uterus contracted.

The recession of the presenting part and the apparent arrest of labour observed on rupture taking place are not absolute evidence of uterine paralysis. They rather prove that the uterus no longer acts in driving the child forward in the natural course.

What may happen if protruding intestine is not returned? 1st. It may be gradually reduced by spontaneous processes. This we have seen ourselves. Cases are not rare. 2nd. It may get strangled in the uterine wound, inflammation and gangrene supervening. Deneux quotes a case. Recovery has been known. In McKeever's case, four feet of intestine sloughed away, and recovery ensued. An artificial anus may form, as in a case seen by Roux (see Duparcque).

The diagnosis.—It is a matter of great clinical interest to know the possible sources of error in diagnosis and consequent error in practice in cases of this kind.

- 1. The placenta.—A child may have been delivered and a placenta has followed. Another placenta may be felt in the vagina or uterus. This would naturally lead to the conclusion that there was another child; and as none might be found in the uterus, it would suggest the inference that there was rupture and escape of a child into the abdominal cavity. We have been called to such a case. The second placenta was a placenta succenturiata. There was no rupture and no second child.
- 2. A rupture may have taken place. The child may have been delivered naturally or artificially, and the cord tied. In searching for the placenta, tracking the cord, the hand may be guided through the rent into the abdominal cavity, where the

placenta may have been cast by the uterus. This we have known.

- 3. A more or less solid blood-mass may present or be felt in utero after the birth of the child. Such a mass may easily be mistaken for placenta, although no cord be attached to it. Such a mass, surrounded by membranes or layers of fibrin, may even to the eye resemble the placenta. And such a mass may come from the abdominal cavity, as in a case published by Robert Barnes in 'St. Thomas's Hospital Reports.'
- 4. Substances other than a child or placenta may be protruded from the uterus. A *fibroid tumour or polypus* may be thrust out after the child has been born. It may be taken for the placenta or a firm clot. It is a most puzzling complication, not unlikely to be attended by rupture.
- 5. An abnormality of the fætus, which might be serionsly embarrassing, is figured in the 'Obstetric Operations,' 3rd ed. The preparation is in St. Thomas's Museum. It shows a sacrococcygeal tumour that might easily be mistaken for a placenta.
- coccygeal tumour that might easily be mistaken for a placenta.

 6. An ovarian tumour may be driven through a rupture of Douglas's sac, as in Dr. Dunn's case ('Virginia Medical Monthly'), and in one by Mr. Berry.
- 7. Omentum may be mistaken for placenta or the membranes. Braxton Hicks relates such a case ('Lancet,' 1875). He was called to what was represented as 'a curious modification of the placenta.' It turned out to be omentum protruding through a rent.
- 8. Intestine may come down into the vagina or outside. But this is not necessarily proof of rupture. The intestine may belong to a child in utero, malformed, having no abdominal wall, as in a case reported by Dr. Sheehy ('Brit. Med. Journ.' 1875); in one by Dr. Meadows ('Obst. Trans.' vol. vii.), and as in a specimen in St. George's Hospital Museum. Or the fœtal abdomen having burst from decomposition or from over-distension from ascites, the intestines may have fallen through. Fœtal intestines are smaller than those of the mother; but the difference may well escape detection by one who in all probability has never felt either the one or the other before.
- 9. Maternal intestine, then, may be mistaken for feetal intestine. And for what else? It has been mistaken for umbilical cord. This, it is said, ought not to occur. It is

easy to be wise after the event. We are all under the dominion of habit. We believe the sun will rise to-morrow because it has done so every day hitherto. The obstetrist, who has never felt anything else but placenta or cord in the vagina, is instinctively led to conclude that anything he feels there which bears to the touch (he is generally precluded from seeing) any resemblance to them is placenta or cord.

There are points that may, however, if critically weighed, lead to differentiation. The cord, after division from the child, is a single string; there is the cut end outside, there is no mesentery; it is tolerably firm, not inflated by air; traced up, it leads to the placenta. On the other hand, the intestine is a hollow tube forming loops or coils; it has an elastic feel less firm than the cord; traced up to its source, it does not lead to the placenta, but through a rent into the abdomen, to its inner border. These differences are generally marked enough to enable an experienced man under ordinary circumstances, in the full possession of his faculties, and retaining his delicacy of touch, aided by sight, to distinguish one from the other. the circumstances are ex necessitate rei extraordinary. The cord, even after being divided, may form loops in the vagina, the cord being carried back into the vagina in searching for the placenta, or lost in clots of blood. If the cord be unusually long —we have known it to be five feet long—loops and coils are easily formed; and a coil of cord of a second child may come down, there being no free end. Then as to the feel. Some cords are as thick as intestine, as in a specimen in St. George's Museum, so resembling intestine as to deceive both eye and finger: Further illustrations of this, one of the most trying situations in obstetric practice, will be found in the 'Obstetric Operations.'.

Experience has brought us this conviction, that before condemning a surgeon or a midwife for mistaking intestine for umbilical cord, or omentum or clot for placenta, we must calmly weigh all the possibilities of error, and make due allowance for the unexpected and rare event of intestinal prolapse. We do not hesitate to say, with all the emphasis that personal observation and extensive knowledge can justify, that those who are most ready to condemn such an error are those whose experience is the smallest.

If intestine protrude through the wound, attempts may be made to return it. This is sometimes extremely difficult, if not impossible. As fast as you push up one part another comes down. Expulsive reflex action is set up, so that the very effort you make to return intestine excites to the expulsion of more.

When the rent is in the posterior wall of the vagina, the difficulty in returning the intestine and in keeping it from coming down again is greater. The opening remains gaping, and all expulsive action bears directly upon it. It has occurred to some that the opening might be stitched up. We do not know that this proceeding has ever been executed. At least we do not know of a published or authenticated case.

An easier proceeding would be to open the abdomen, to draw back the intestine, and then to stitch up the wound. But still, the best plan would be to perform Porro's operation—an operation which leaves nothing undone.

During collapse perfect rest is absolutely necessary. The flagging energies may be sustained by repeated subcutaneous injections of ether; and beef-tea enemata containing brandy will also be useful.

E. Injuries of the pelvic joints, ligaments, and other structures. The softening of the joints in gestation and parturition has been discussed (Vol. I. p. 144). Occasionally, under the simple excentric pressure exerted by the fœtus upon the pelvic girdle, inflammation of the joints is caused. This is more frequently noticed in the pubic symphysis. This may proceed to abscess. But more formidable injuries result from the use of instruments, especially of the forceps. It would not be altogether justifiable to affirm that such injuries might always be avoided. But certainly, if the forceps be only used in proper cases and with due skill, observing axis-traction, they will be extremely rare.

Contracted pelvis will be a predisposing cause. The symphysis pubis bears the chief brunt of violence during instrumental labour, vicious traction telling most upon the anterior wall of the pelvis.

The subject has been well studied by Ahlfeld (Die Verletzungen der Beckengelenke während der Geburt und im Wochenbette. Schmidt's Jahrb. 1876).

Injury to the pelvis is not limited to the joints. Instruments may so contuse the last lumbar and upper sacral vertebral bodies and the interarticular cartilages that necrosis follows. The bones have been bared by the laceration of the covering soft structures. But in some cases the cartilages have been injured, the peritoneum remaining intact.

Injuries of the bladder and wrethra may be produced under the pressure and contusion arising during labour, chiefly where there is disproportion; or from crushing by instruments, most frequently the forceps. The anterior wall of the pelvis bears the chief brunt of the vicious force in labour. In using the forceps the edge of one blade is apt to come forward towards the symphysis, and the ordinary forceps often demands the highest skill in so directing traction as to diffuse the pressure equally on the pelvic girdle.

The bladder may burst from over-distension, as in retroversion of the gravid womb. This has been adverted to in the section on this condition.1

J. Ramsbotham relates the case of a woman, aged 36, in whom, after protracted labour and retention of urine, a hole, the size of a finger, was found in the uterus; peritonitis ensued. This may be regarded as a case of simple intraperitoneal rupture.

T. E. Rawson² relates a case of a woman who, a month after labour, had sudden collapse—a small ulcerated opening was found at the summit of the bladder. Hey relates a similar case. The woman died on the eighth day after labour attended by distended bladder.

Rupture during labour is described by Velpeau by Blundell.

The bladder may be directly torn during delivery by the forceps, as in a case which happened recently in London. The patient died, after sewing up the wound. This case, so far as we know, is unparalleled.

Fave relates a case 3 in which the bladder was ruptured under the use of ergot for obstructed labour from an armpresentation.

Much valuable information upon this subject will be found

in the excellent monograph of Walter Rivington 'On Rupture of the Urinary Bladder,' 1884.

The practical lessons to be drawn from these catastrophes are obvious.

Vesico-vaginal fistulæ are more commonly the result of necrosis of the tissues of the septum than of laceration at the time of labour. In the majority of instances it is only after several days that urine is observed to escape by an abnormal opening in the bladder or urethra—that is, after the slough of killed tissue has come away. In the meantime there is likely to be paralysis of the bladder, compelling resort to the catheter.

For further information upon this subject reference is made to the 'Clinical History of the Diseases of Women.' The chief obstetric interest lies in determining how to obviate this evil. This depends almost entirely upon attention to two points—first, to watch against protracted labour, which involves long pressure upon the soft parts engaged between the child—especially the head—and the pelvic wall; secondly, to use due care in the use of instruments, so as not to bear unduly upon the same parts.

Recto-vaginal fistulæ are more rare. Their history is similar, but from the posterior wall of the vagina being less exposed to crushing between the child and projecting bone than is the case with the anterior wall, when this lesion occurs it is more likely to be the result of direct injury.

E. INVERSION OF THE UTERUS.

Acute and Chronic; Spontaneous or produced by external force; How Produced; John Hunter's Theory; Crosse's; Lazzati's; Three Degrees; Course; Treatment.

Inversion of the uterus is an accident of labour which may most usefully be studied in connection with rupture. In the suddenness of its occurrence, in its instant danger, in the call for prompt recognition and remedy, in its occasional combication with rupture or laceration, and in its medico-legal relations, it has many points of connection.

Definition. Inversion may be simply defined as a turning

inside-out of the womb. (Inversion, rovesciamento, Umstülpung.) The fundus falls through the cervix, coming out at the os externum, so as to form a new cavity, the lining of which is the external or peritoneal coat of the uterus.

Inversion may be complete or partial. Crosse describes three degrees (see fig. 49)—(1) Depression; (2) introversion; (3) perversion or complete inversion.

Inversion is acute or chronic. The true distinction was defined by Robert Barnes. Acute inversion ends with the complete involution of the uterus. When this process is complete, the case is chronic. The distinction is based upon the important physiological fact that, whilst involution is going

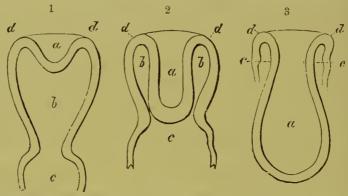


Fig. 49—Showing three degrees of Inversion. 1. Depression. 2. Introversion. 3. Complete inversion. (Crosse.)

a. Fundus of uteri. b, b. Cavity of uteri receiving inverted fundus. c. Vagina. d, d. Mouth of inverted portion.

on, the muscular walls still retain active contractility, the organ is larger, and the cervix is comparatively yielding. During this stage the parts are more yielding and reduction comparatively easy. The history of the chronic form is traced with care in the 'Clinical History of the Diseases of Women.' Our present concern is limited to the recent or acute form of the accident. We introduce an illustration of the chronic form in order to give a correct idea of the relation of the parts (see fig. 50).

Inversion like rupture, may be spontaneous or produced by external violence.

Frequency. The accident is so rare nowadays that many men of large experience have never seen it. In former days it was not uncommon; and this may still be said to be the case

¹ Samuel Cooper's Surgical Dictionary, Samuel Lane's edition.

in countries where obstetric practice is largely in the hands of women. Like other of the great catastrophes of midwifery, it has become rare in proportion as the art has improved. Thus it is all but unexampled in the records of the Dublin Lying-in Hospital. It is, in fact, such a rare accident that it is impossible to give any statistics relative to its frequency which could be said to be trustworthy. Ruysch tells us it was not uncommon in Holland in his day, when midwives were generally employed. Denuce ¹ collected 330 cases of inversion.

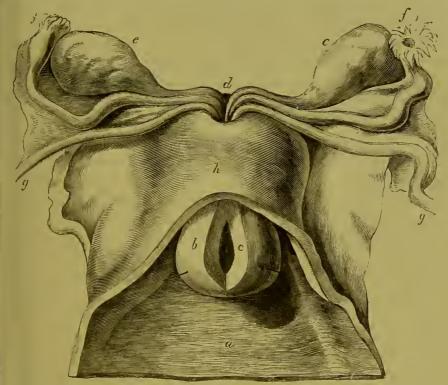


Fig. 50.—Two-thirds size. (After Crosse.) Specimen in Musée Dupuytren.

a. Vagina. b. Inverted fundus incised at c to show its cavity. d. Point of inversion, with round ligaments, tubes, and ovarian ligaments drawn in. e, c. Ovaries. f, f. Finbriated ends of tubes. g, g. Round ligaments. h. Cervix covered by peritoneum.

But although, as a general rule, it may be true that the frequent occurrence of inversion is indicative of bad practice, it would be wrong to apply this absolutely. Now and then instances occur, and will occur under skilful hands, and when approved principles of conduct have been sedulously observed.

We must therefore carefully study the modes in which

1 Inversion de l'Utérus, 1883.

inversion—spontaneous, or induced by external violence—is brought about.

The following circumstances have been noticed in the histories of cases of inversion associated with labour:—1. It has occurred almost always, if not invariably, immediately after the expulsion of the child, and during the delivery of the placenta. 2. In a large proportion of cases the accident followed pulling upon the cord, or other forcible attempts to deliver the placenta. It occurred in one case, which came in the chronic stage into St. George's Hospital under Robert Barnes's care, under manual 'expression of the placenta.' Other similar cases are reported, and several histories state that inversion occurred during strong pressure upon the abdomen. 3. In other cases the cord is noted as having been unusually short or twisted round the child's body, so that undue traction would be exerted on the placenta during the expulsion of the child. 4. In some cases there was adhesion of the placenta, and efforts to detach it have been followed by inversion. 5. In some cases, where there is no mention of the placenta having been meddled with, the delivery was very rapid. 6. In some cases the labour was natural but slow, characterised by inertia. 7. It has occurred in primiparæ as well as in women who have borne many children. 8. Delivery in the erect posture has in several cases been attended by inversion. 9. It has happened after delivery by forceps and ergot. 10. A frequent attendant condition, the placenta being still in utero, has been hæmorrhage.

It will be observed that some of the foregoing conditions, if not all, imply inertia or flaccidity of the uterus, and that others give evidence of a vis à tergo pushing the uterine fundus down, or of a vis à fronte pulling it down. Indeed, both these conditions mostly concur.

Inversion during pregnancy. Dr. Woodson relates a case which occurred at four months, and Dr. John A. Brady one which followed abortion at five months. Both recovered after reposition.

Inversion has in a considerable number of cases occurred in the non-pregnant state, so far as we can learn, from the dragging or expulsion of a tumour. The history of this class

¹ Amer. Journ. of Med. Sc. 1866. ² New Yor

² New York Med. Times, 1856.

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of cases is studied in the 'Clinical History of Diseases of Women.' There is a good specimen (Hunterian) in the College of Surgeons. The case formed the basis of John Hunter's theory of the production of inversion.

Causes or conditions under which inversion has been observed. The fact of inversion has not seldom escaped detection at the time of its occurrence. It undoubtedly takes place in the great majority of instances during the placental stage. But, not having been observed at the time, some have supposed that the uterus might undergo spontaneous inversion hours or days after labour. Ané, Baudelocque, and Dubois cite cases. This hypothesis rests upon the negative fact that no inversion was observed at the time of labour, and then upon the positive fact that an inverted uterus was found at some subsequent date. This kind of evidence is hardly satisfactory. It is probable that in some cases there was partial inversion at first, and that inversion was completed gradually subsequently.

The essential conditions for the production of inversion are considerable enlargement of the cavity and relaxation of the whole or part of the walls of the uterus. When the uterus has contracted, its walls are so thick, and its cavity is so reduced, that, the anterior wall being flattened close in contact with the posterior, inversion cannot take place. The extreme flaccidity of the uterus has been distinctly described by many observers. Thus, Smellie relates a case told him by Lucas of a woman whose uterus, after inversion, was immediately reinverted. It was 'like a piece of tripe.' The uterus has even been inverted after post-mortem delivery. In 'Guy's Hospital Reports,' 1864, Alfred Taylor relates a case communicated by Mr. Bedford, of Sydney. A woman, aged thirty-seven, died in labour with her seventh child. She had had violent pains, but it was clearly ascertained that the head, although low down, had not been extracted. Inspection of the exhumed body was made a week after death. The abdomen was much distended by decomposition. A male child was found between the woman's thighs. The uterus was inverted, and, with the placenta attached to it, was also outside the vulva. There was also a rupture of the uterus a little above the cervix, transverse, and about six inches long. The conclusion arrived at was that the rupture occurred during life, and was the cause of death, and

that the expulsion of the child and inversion of the uterus were caused by the pressure of gases in the abdomen. The uterus was flaccid.

Hæmorrhage is a disposing cause. Whoever has had his hand in the cavity of a uterus powerless through loss of blood, who has felt its flaccid walls yielding to every pressure 'like tripe' or wet brown paper, will understand how easy it would be for such a uterus to be inverted. Indeed, we have often felt partial inversion taking place whilst endeavouring to detach adherent placenta by the fingers. Lazzati distinctly says that the uterns is inert at the time of inversion. Whilst in this state dragging upon the placenta may easily pull down the fundus and turn the uterus inside ont; or pressure upon the fundus from without, as by the hand forcing it down, or by the expulsive action of the abdominal muscles, voluntary, reflex, or in the act of vomiting, may drive the fundus down, and even through the os uteri.

We may, then, have spontaneous and artificial inversion during an entirely passive state of the uterus.

It is certain, however, that the uterus may be inverted by a spontaneous active self-inversion. The process was described by John Hunter. A polypus had grown from the fundus uteri. A ligature had been applied near the attachment. The tumour had slonghed off just before the patient died. Hunter described the case under the title of 'Intussusception,' to which he likened inversion. 'The uterus,' he says, 'is liable to inversion from two causes: one is immediately after labour, when it is so large as to admit of its containing itself, and which is commonly from an imprudent mode of disengaging and bringing away the placenta, when that substance has been attached to the fundus of the uterus. The second is somewhat similar namely, the expulsion of an adventitious body-although of another kind, and at a very different period in the state of this viscus. It begins to take place when this viscus is small, but becoming gradually large enough to admit of an inversion; so that, in the first case, the uterus is first large, so as to admit of an inversion, and by its contraction to its natural state, as it were, fixes it. This is done immediately, because its cause is immediate, for this enlarged state of the uterus is of short duration; but the second is gradual, because it is to produce

itself by the very action of the uterus in expelling an unnatural body (such as a polypus). The polypus, as it grows, will gradually fill the cavity of the uterus, and the uterus will be constantly endeavouring to remove it. The action of the uterus will be downwards, and as the body of the uterus acts on its substance it will be gradually squeezed down towards the os tince, and the fundus will, of course, be drawn gradually into its own cavity, and as the polypus is squeezed down so will the fundus follow. When the whole length of the polypus has got into the vagina, if it has no length of neck, then will the fundus uteri be as low down as the os tince, the upper half of the uterus just filling the lower half; but I conceive it does not stop here. I conceive the contained or inverted part becomes an adventitious or extraneous body to the containing, and it continues its action to get rid of the inverted part, similar to an introsusception of an intestine.' It is remarkable that in the subject of this case an introsusception of the small intestine coexisted.

We have quoted this description at length because it contains the germ of most subsequent theoretical explanations. A similar theory was set forth by Crosse, who also points out that one of the most constant conditions is attachment of the placenta to the fundus uteri. Denman also says that, if a disposition to an inversion be first given by the force in pulling the funis, it may be completed by the action of the uterus. Tyler Smith seized the same idea, and expressed it in his usual lucid manner.

An important factor has been insisted upon by Rokitansky. Inversion begins at the placental site. This part, says the great pathologist, is liable to paralysis, and, being thicker than the other parts of the uterine wall, forms a projection into the cavity. That is the first step; the first postulate of Hunter. Then, if the placenta adhere, and be dragged upon by the cord from below, or if the abdominal walls act as in a bearing-down effort, the part already disposed to fall inwards is forced further down into the cavity. The external cup-like depression—Crosse's first stage (see fig. 49, 1)—formed by paralysis of the placental site, may be felt by examination through the abdominal walls, and especially is this the case if traction be made upon the cord, the placenta adhering. When things have gone

thus far, the whole body of the uterus being at the time inert, a little further pressure or dragging brings the fundus down upon the cervix—Crosse's second degree, or introversion (see fig. 49,2). If this part be contracted, it may prevent the fundus from slipping through; or, the pressure continuing, the cervix may yield and allow the fundus to slip through, as it does in the ordinary labour, or in the converse case of artificial reposition; or the advancing fundus may find the lower segment and cervix flaccid, and offering no opposition. Indeed, the cervix is very liable to temporary paralysis after labour, and especially is this the case when it is lacerated. Accordingly, it has been observed that some cases have occurred gradually, others suddenly.

It may be supposed that the uterine ligaments would offer sufficient resistance to obviate spontaneous inversion; and the inference from this assumption would be that inversion must be the consequence of direct violence. But in reality this resistance is easily overcome. During gestation the ligaments become elongated, so as to be easily drawn into the hollow or cup formed by the inverting body of the uterus. The moorings of the fundus are too slack to keep this part up; but, on the other hand, the connections of the cervix, to its ligaments, to the bladder and vagina, hinder the inversion of this part for a time. And Casper says laceration of the ligaments may attend spontaneous inversion of the uterus. Hence one explanation of the greater frequency of the two first stages of inversion.

We may, then, upon these data, summarise the conditions for inversion. We find, 1. That inversion may be spontaneously produced by the driving force of the abdominal muscles, aided, perhaps, by the dragging force of the placenta, pushing or pulling the paralysed and bulging fundal placental site through the relaxed cervix, or artificially produced by pushing upon the fundus, or by pulling upon the fundus by traction upon the adherent placenta. In these two forms, paralysis of the entire organ is the essential condition. 2. We have not absolute inertia, but paralysis of the fundal seat of the placenta. With depression, this part, as Hunter and Tyler Smith explained, is caught in the lower zone of the uterus, and, exciting it, as a foreign body or polypus, to act, the introcedent part is driven down through the cervix. In a similar manner, the first

stage of depression or introcession is effected artificially by traction upon the cord, or by pushing as in 'expression,' when the introcedent part is caught by the lower segment of the interns and expelled. Duncan and Taylor, of New York, point out that in some instances inversion begins at the cervix, which is rolled out or everted by the superincumbent pressure of the body of the uterns.

The symptoms and diagnosis of recent inversion. The symptoms are chiefly those of shock, indicating sudden severe injury. They vary with the degree and progress of the inver-

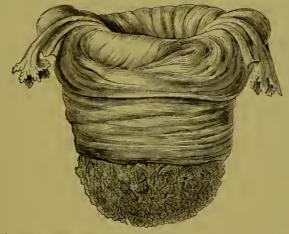


Fig. 51.—A nearly complete inversion of uterus in recent state, the placenta removed. One-third size. (Dr. Chambers' case.)

The fallopian tubes and round ligaments are hanging out of the infundibulum formed by the inversion. The rough surface at the lower part is the placental site. A secundipara æt. 27. Half-an-hour after child's birth hæmorrhage set in, the placenta being not yet expelled. The midwife pulled upon the cord; the patient had severe abdominal contraction, uttered a violent shriek of pain, and a round, ovoid body protruded from the vulva. The patient was moribund when seen. No opportunity for replacement.

sion. Thus, the first degree or simple depression (see fig. 49, 1) may be unattended by pain, and be indicated solely by hæmorrhage and a corresponding depression of the vital powers. The hæmorrhage comes from the relaxed projecting placental site. As the descent proceeds and becomes introversion (see fig. 49, 2), urgent symptoms arise, according to the degree of compression exercised by the uninverted portion upon the inverted portion A sense of fulness, weight, as of something to be expelled, is felt. The woman has thought another child was passing, or that the placenta was coming. Expulsive efforts, uterine and abdominal, sometimes very violent, follow. Hæmorrhage is not

constant. It seems that, when the inverted portion is firmly compressed, the hæmorrhage is arrested, and that bleeding is a mark of inertia. When there is inertia, hæmorrhage is often profuse and continuous. When the inversion is complete, pain and collapse are aggravated. Clammy sweats, eold extremities, vomiting, alarming distress, restlessness, extinction of pulse follow.

During the expulsion the woman has often exclaimed that 'her body has eome out,' or that the attendant 'is tearing away her inside'; and this even when no one may have been touching her. Perhaps convulsions set in, but generally consciousness is retained.

When examination is made, the appearance of an unusual mass is observed outside the vulva. This may be as big as a child's head, or bigger. In Middlesex Hospital Museum is a specimen as large as the adult head hanging from the vulva. There was also rupture, both said to be produced by the midwife pulling upon the cord. The depending mass is fleshy, firm, rounded or pyriform, dark red, bleeding, probably partly obscured by blood-clots. The cord, if the placenta had not previously come away, and if the cord had not been torn off, will be hanging from the mass, and, being traced up to its root in the placenta, may give the impression that it is placenta and nothing more. Under the influence of this impression, the first impulse may be to seize the mass and try to remove it; and the profuse attendant flooding may add urgeney to this impulse. But deliberate examination will show that the hand cannot be passed up beyond the presenting mass or presumed placenta into a cavity like the vagina or uterus; the hand is arrested all round the root of the mass by a groove low down in the pelvis, or even outside the vulva; feeling above the pubes for the uterus, it is not found where it ought to be, but the hand sinks in, earrying the flaccid wall before it quite back to the spine, and even into the pelvic cavity. The uterus, then, is not where it ought to be, and there is a body of corresponding bulk and shape where no such body is usually found. The inference is strong, if not conclusive, that this body in a strange place is the inverted uterus.

The diagnosis may be made clear or absolute (1) by passing a finger into the rectum, and then passing the fingers of the

other hand above the pubes back towards the sacral promontory; if the two hands are thus brought to meet, the absence of the uterus from its proper place is established. (2) There is another test. The fingers, dipping into the pelvis, find their way into the hollow formed by the inverted uterus, and the round ligaments may even be made out running into this hollow. Upward pressure of the procident mass will bring these signs into greater relief. (3) Or there is still another test. The finger in the rectum reaching above the procident mass, a sound or catheter is passed into the bladder, and the coneavity turned backwards; the point reaches over the procident mass, and is felt by the finger in the rectum.

If the placenta still remains attached, the mass will be eorrespondingly larger. It ought to be known whether the placenta have come away or not. The cord will afford a ready clue if it have not been torn off. In all cases of difficulty the doubtful body should be inspected by the eye if possible, as well as by the touch. The ramifications of the umbilical vessels over the surface of the mass and the torn membranes will reveal the placenta. A placenta in this position is presumably detached, and removable without further force. If it be found that it cannot be so removed, the reason of the resistance must be carefully sought. The membranes should be drawn forwards so as to bare the edge of the placenta; it will then be felt, and seen to be attached to a spherical body, which is almost certainly the uterus inverted. Not quite certainly, because cases are known where the placenta has grown to the child's head, or to a polypoid tumour projecting from the uterine cavity. This second case is one of real difficulty—the more so since the polypus may have caused inversion of the uterus. There will then be three masses in very unusual connections: placenta, tumour, inverted uterus.

Whilst we are making all this out, the patient may be dying of shock and hæmorrhage. Still, however urgent the need of help, there is more danger in precipitate, unreasoned efforts than in the procrastination necessary to take an accurate survey of the situation, and to deliberate on the proper course of action. By taking time we shall probably do what is right.

The recently-inverted uterus has a remarkable property

which distinguishes it from every other tumour. Contractility

is a property that no polypus possesses. If the tumour, then, hardens and relaxes alternately, we know it is the uterus.

The recently-inverted uterus is also usually very much larger than a polypus. And the polypus traced up to its root or origin will lead to a cavity—the cavity of the uterus.

The case of incomplete inversion—that is, in the stages of depression or introsusception—may be very difficult to diagnose from polypus. There may in both cases be a tumour above or engaging in the cervix. The finger or sound will pass into the nterine eavity around the base or neck of the tumour. The diagnosis will depend upon being able to feel the inverted cup of the fundus through the abdominal wall, whilst a finger of the other hand is in the uterus. In the case of polypus, no such cup is felt, but the body and fundus of the uterus are felt in their usual relations and convex shape. Bimanual palpation and the sound determine these points.

Should the placenta have come away, the ease, although so far simplified, is still not free from danger of mistake. There is a large, rounded, fleshy mass, bleeding, hanging between the thighs. It may be mistaken for placenta, for some part of a child, normal or abnormal, for a polypus or other tumour, or even for a mass of eoagulated blood. If you have been following the uterus down during the extrusion of the placenta, or afterwards to ensure contraction, and suddenly feel the uterus retreat into the pelvis, a firm mass appearing simultaneously in the vagina or externally, you have, with the symptoms of shock, strong presumptive evidence that the uterus has become inverted. You may make this sure by pushing the tumour back a little up the vagina with one hand whilst you press in the flaeeid abdominal wall, with your other hand, behind the symphysis. The cup-shaped depression formed by the introeedent fundus uteri may thus be felt.

Course, terminations, prognosis. 1. The patient almost immediately or soon after the accident dies from pure shock. The shock attending simple depression has proved fatal.

2. More frequently death occurs rapidly from shock and hæmorrhage combined—that is, within twelve hours. 3. The inverted uterus may be strangled by its own cervix or by the vulva. This induces continuous or secondary shock, and in some cases, if the patient survives long enough, and it need

not be long, gangrene ensues. The uterus has sloughed off. Saxtorph, Deboirier, Radford, E. Clemensen give examples. R. Milne Murray ¹ relates a case in which the uterus was found inverted twenty-four hours after spontaneous expulsion of placenta. It was replaced without difficulty, but was again found inverted on the following day. On the thirteenth day the nterus sloughed off without hæmorrhage. The patient recovered. In other cases the strangulation has ended fatally before there was time for sloughing (Velpeau). Death has ensued from strangulation of intestine in the uterus. Gerard de Beauvais relates a case.²

4. In some cases, and these not rare, the shock and hæmorrhage are not very severe, or, at all events, the woman survives
the immediate effects, rallies, and is thought to be safe.
Tolerance, more or less complete, may ensue. But generally
metrorrhagia continues, interrupted perhaps at intervals, but
always liable to recur at the menstrual epochs. The losses
thus induced may prove fatal at no distant date.

In the recent state, retention of urine, owing to the distortion and compression of the neck of the bladder and urethra, is not uncommon. This has been relieved when the uterus was restored. But congestion of the mucous membrane of the bladder, cystitis, even retrograde kidney trouble, may ensue, as in retroversion of the gravid uterus.

- 5. When the case is not fatal, and the uterus is not reduced, it merges into the chronic form. For the history of this form we must refer to the full description given in the 'Clinical History of the Diseases of Women.'
- 6. Meigs and others affirm that spontaneous reposition has occurred. This is denied by Crosse. A case, however, related by Spiegelberg ³ seems clear. Denham relates ⁴ a case in which spontaneous reduction completed reduction that could only be partially effected by the taxis. Some cases related are open to doubt. A polypus may have dropped and have been mistaken for the nterus. But there seems no reason to question that inversion in the first and second degrees may be reduced spontaneously. We have only to suppose that the lower segment

¹ Edinb. Med. Journ. 1883. ² Arch. de l'Acad. de Méd. 1843.

³ Arch. f. Gynäkologie, vol. v.

⁴ Dubl. Quarterly Journ. of Med. Science, 1866.

of the uterus, contracting below the equator of the introcedent globular mass, may cause this mass to spring back into its place. We have, indeed, observed this ourselves in the first degree of depression.

Treatment. When we find inversion the indication is clear to reduce it, and that as soon as possible. If we can catch the happy moment whilst the uterus is still flaccid, reduction is comparatively easy. Indeed, Lazzati and most authors state that as complete inertia is necessary to the production of inversion, so it is also necessary for reposition. The time at disposal is short. The presence of the uterus, grasped in its own neck, excites contraction, the part gets strangled, and it becomes more and more difficult to return it. It was at one time considered a hopeless task to persevere in attempts at reduction unless it was accomplished within an hour.

The first question to determine is the fitness of the patient to endure the operation. If prostration be marked, lose no time before injecting a drachm of ether under the skin. The catheter should be passed as a rule.

The posture of the patient is the left lateral, inclining to the prone. The pelvis is drawn near to the edge of the bed, the knecs well flexed upon the abdomen. Anesthesia by ether may be desirable, but not at the sacrifice of time.

The second question that arises is as to detaching the placenta first or not. To detach the placenta is to lose a little time, to risk flooding and irritating the uterus to contract; if we leave it, there is the greater bulk to pass through the cervical ring. If we have the good fortune to recognise the accident at the moment, we may be able to take advantage of the flaccidity of the cervix and return uterus and placenta at once. But if this favourable moment is lost, it will be better to detach the placenta first. This is done by finding the margin, insinuating one or two fingers between it and the uterine globe, supporting the uterus by the other hand, and peeling off the placenta by sweeping the fingers along. When the placenta is wholly detached, proceed to reduce the uterus. The mode of manipulation must vary according to circumstances. If the uterus is large, flabby, and the cervix dilated, it may be quickly replaced by depressing the fundus with the fingers gathered into a cone, and carrying the hand onwards through the os.

Lazzati says it is better to apply the closed fist to the fundus; this acts better, and avoids the risk-by no means a slight oncof perforating the soft structure of the uterus. In executing this manœuvre two things must on no account be omitted: one is, to support the uterus by the other hand pressing firmly down upon it from above the symphysis, lest the vagina be lacerated. The vagina is very extensile after labour It sometimes elongates under pushing so readily that we may fail to realise whether it is stretching or rending. The other thing to observe is the course of the pelvic axes and the form of the pelvic brim. This knowledge will guide the direction of pressure. Pressure it first should be made a little backwards towards the hollow of the sacrum; then the direction must be towards the brim, and it the same time to one side, so as to avoid the sacral promonory. As in attempts to reduce a retroverted gravid uterus, ailure has often ensued from not understanding this. It was, ve believe, first insisted upon by Dr. Skinner, of Liverpool. By attention to this rule we have reduced a uterus in fifteen ninutes which had been inverted for ten days, defying reeated efforts by other surgeons. The side to select is the left; he patient lying on her left side, the uterus thus more easily lips past the promontory. When reduction has been accomlished, the hand, following the receding fundus, will occupy the avity of the uterus, and the organ will be grasped between the and inside and the hand supporting outside. Care should be iken to avert what has happened, namely re-inversion. To ecure this, pass up along the palm of the hand a uterine tube onnected with an injecting syringe; throw up a pint of hot ater (110° F.), and if the uterus is felt to contract, the hand ; withdrawn; if contraction do not follow, throw up a styptic olution, such as perchloride of iron. The effects of this are: onstriction of the mouths of the vessels, arrest of hæmorrhage, xcitation of uterine contraction, corrugation of the tissues, and arrowing of the cervix uteri. When this state is induced we uay look with confidence for safety. Dr. Spearing published case in which reinversion occurred immediately after reduction. he woman died in fifteen minutes after reduction.

If uterine action be present, especially if the cervix is conringing the inverted part, contracting spasmodically, the fficulty is greater, and it is no longer judicious to commence Vol. II.

by pushing in the fundus. McClintock showed that doing this is to double the inflexion of the uterine walls, and thus to double the mass that has to pass through the os. He advised to regard the inversion as a hernia, and to replace that part first which came down last. The tumour must be grasped in its circumference near the constricting os; frmly compressing it towards the eentre, and at the same time pushing it upwards, forwards, and to one side. The pressure must be steadily kept up, as the resistance of the os is overcome by sustained pressure. After a time the os is felt to relax, the part nearest is pushed through, and then, generally suddenly, the body and fundus spring into position. This proceeding is best carried out under ether.

Dr. Noeggerath insists upon the advantage of indenting the fundus first at one or other of the angles where the tubes enter. This oblique iudentation he says is far more effective than indenting in the middle of the fundus. There seems to be a sound physiological as well as clinical argument in favour of this proposition.

If the opportunity of reducing within a few hours be lost, the difficulty increases through advancing involution of the uterus, and especially contraction of the cervix. But still reduction is simply a question of time and skill. The principle of steadily sustained elastic pressure, advocated and practised by Tyler Smith, has given excellent results. For information upon this point we must refer to the 'Clinical History of the Diseases of Women.'

Reduction, however, does not always ensure recovery. Many patients have died soon after reinversion. In some instances, perhaps, further injury has been inflicted during the operation. But it must not be forgotten that laceration of the vagina or uterus may have been spontaneously produced at the same time as the inversion.

In some critical cases, in which the uterus is partly torn from its connections, the question may arise whether it be not better to complete the removal of the organ by the knife or scissors, having first transfixed the root by needles and secured the opening by sutures. The proceeding seems desperate, but circumstances may justify it.

¹ J. G. Wilson, Glasgow Med. Journal.

The after treatment will consist in absolute rest, opiate suppositories, or chloral enemata, containing one drachm of chloral, ice, and appropriate means to arrest vomiting.

In subsequent labours increased disposition to inversion may be anticipated. There are several cases in which inversion

has happened in successive labours.

Retroversion and retroflexion with prolapsus, and anteversion and anteflexion may follow labour. These accidents have been referred to under 'Hæmorrhage.'

Subinvolution has been referred to in the 'History of Puerpery.' The chronic state passes under the 'Diseases of Women.'

The nervous disorders have been described in connection with the neuroses of gestation, labour, and puerpery (see Vol. I. p. 418).

Disorders of the circulation and lungs are described as part

of the 'History of Puerpery.'

Retention of the placenta has been studied in connection with the 'Diseases of the Ovum' and 'Abortion' (see Vol. I.). It has also been referred to in connection with post-partum hæmorrhage. It is still desirable to give a brief account of other relations of this complication. It has been elaborately described by Hegar, Hüter, Fromont, and others.

It may be stated briefly that retention is due (1) to defective or irregular action of the uterus, or (2) to morbid adhesion. The first order of causes has been sufficiently considered in the section on the management of the placental stage of labour, and the second in the section on 'Secondary Hæmorrhage.'

Stadtfelt 4 states as a cause that the placenta may be too loose in texture, so that the lobes are easily separated from one another, and one or more may be left behind. This applies especially to the small accessory lobes. He says, out of seventy autopsies he witnessed of women dying in puerpery, large remains of placenta were found in seven. David Davis and Ramsbotham believed that a frequent cause was inflamma-

¹ Die Pathologie und Therapir der Placentaretention, 1862.

² Die Mutterküchenreste, Momatsschr. f. Geburtskunde, 1857.

³ Mémoire sur la rétention du plarrata, 1857. ⁴ Dublin Quart, Journ. of Med. 1863.

tory exudation between placenta and uterus. Wigand said it was due to scrofulous or arthritic condition of the body.

Another cause is the forcible extraction of the placenta. Even when there is no morbid adhesion, such disorder in the action of the uterus is induced that the placenta may be torn, and pieces remain behind.

The placenta may be retained entire or in part. It may be expelled or removed several months after labour, no other consequences resulting beyond hæmorrhages and arrested involution.

Caseaux points out that in such cases the freshness of the placenta is accounted for by the integrity of its vascular connections with the uterus. Hæmorrhage is the most constant attendant. But where the relation with the uterus is entirely or in great part lost, the placenta is liable to undergo putrefactive change. This may or may not be attended by septicæmic fever or inflammation. In the case of putrefaction, physometra or tympanites uteri is likely to result. The cervix uteri being excluded, either by a mass of blood or the placental mass lodging over the os internum, gaseous accumulation takes place, distending the uterine cavity to the extent of notable enlargement. It thus rises considerably above the symphysis pubis. Commonly great pain and tenderness on pressure are felt; some irritative fever, with rise of temperature and pulse, with a sallow aspect, indicate toxemia.

One consequence of retention of a bit of placenta is that it may form the nucleus upon which layers of blood may aggregate, forming the placental and fibrinous polypus.

Treatment.—Two conditions attend all the forms of the retention—namely, hæmorrhage and excessive bulk of the uterus. Now, as a general rule, hardly admitting of exception, whenever these conditions exist, the cervix should be dilated, and the cavity of the uterus explored, under anæsthesia if necessary. The noxious substances can then be cleared out. This done, irrigation with carbolic acid solution, 1 in 50, or with bichloride of mercury, 1 in 3000, should be used for some days. Quinine, ergot, and digitalis will also be useful.

Nonat described fongosités intra-utérines as placental remains. Small polypoid excrescences keep up hyperplasia and

¹ Traité pratique des Maladies de l'utérus, 1860.

hæmorrhages. We have seen many examples. Some were malignant, and could not be traced back to labour. Here, again, the treatment indicated is to dilate the cervix to get good access to the cavity of the uterus, and to deal with the excrescences by scraping or application of iodine or nitric acid. If of placental origin a cure may be anticipated. Scraping must be practised with gentleness and caution, lest the instrument penetrate the substance of the uterus.

In like manner, shreds of membrane may be retained. Like the placenta, the membranes may contract morbid adhesions. Similar consequences attend, and similar treatment is indicated.

CHAPTER VII.

ON SUDDEN AND QUICK DEATH IN GESTATION, LABOUR, AND PUERPERY, THROMBOSIS, EMBOLISM, APOPLEXY, SHOCK, AIR IN VEINS—INJURY OF SPLEEN, ILEUS, AND REMANENT LESIONS AND DISEASES FROM GESTATION AND LABOUR.

DEATH may happen quickly—that is, after very brief warning of danger, or even suddenly, without warning. This event may occur during gestation, labour, or puerpery.

It is of importance to study this subject apart from the systematic description of the diseases and accidents, some of which issue in death more or less sudden. When death occurs suddenly, the first impulse of the friends or assistants is not seldom to suspect that the doctor is to blame. No doubt this suspicion may sometimes be justified. But far more frequently it will be found that the catastrophe was beyond his immediate control. We use the qualification 'immediate,' because in some cases the catastrophe might have been averted had the opportunity been afforded of applying proper treatment during the initiative conditions. But in many instances no opportunity for prophylaxis has been afforded. And in some cases, even where the physician has the opportunity of antecedent observation, the course of the lethal events may defy his skill.

Classification of the Causes of Sudden Death.

The causes may be most usefully analysed into—(1) Those which occur during gestation; (2) those which occur during labour; and (3) those during purpery. Similar causes may lead to death in each of these three epochs; but in each cpoch there are causes more especially operative.

1. Causes of sudden death during gestation.—It may seem paradoxical to state that death, sudden or slow, may occur,

apart from violence, in a healthy subject. Still, if it be granted that some morbid condition must be in existence, it is nevertheless true that it cannot always be detected, even after death. Reference to the chapter on the 'Diseases of Gestation' (Vol. I.) will shew that the normal conditions evoked are sometimes so exaggerated as to overstep the narrow boundary between physiology and pathology. Without serious organic change, the functional energies may be so exalted that the organs cannot bear the unwonted strain. In this sense the heart, for example, although substantially sound, may be overpowered—paralysed.

But in other cases there is decided structural disease, as of the nervous centres, lungs or circulating system, pre-existent, or developed during gestation. In such cases, the intensified functional strain will naturally tell more severely.

As in the non-pregnant, sudden death is immediately caused by oppression of one of the great vital centres, the brain and medulla oblongata, the lungs and the heart. The first blow may strike any one of these centres; but the others are quickly involved, and it is not always easy to discover which was the first to suffer.

We believe that it is more in accordance with clinical observation to begin with the heart. Indeed, sudden death is most frequently associated with changes in the vascular system. Under violent emotion fatal syncope may occur, the ordinary physiological hypertrophy of the organ being the only condition detected. De Cristoforis relates a case which occurred in the wards of Professor Esterlé. A woman took an excessive meal, and under the commotion of vomiting died in a few moments. She had the normal hypertrophy of the left ventricle; the texture of the myocardium was intact. There was ædema of the lungs and disturbance of the circulation dating from the seventh month. Cæsarian section was performed post-mortem.

In other cases, marked fatty degeneration of the myocardium has been observed. In two cases, in which death occurred suddenly towards the end of gestation, Robert Barnes detected this change. In one, the immediate cause was excessive exertion.

Death has occurred suddenly under severe straining at stool. Thus, Robert Barnes assisted at the autopsy of a young

¹ Annali Universali di Medicina, 1867.

primigravida at the Clinique d'Accouchements at Paris. She was near term. She died as if struck by lightning when at stool. There was found a hydatid in the wall of the aorta just above the valves, which had caused thinning of the wall, so that when it burst, rapid effusion of blood took place into the pericardium.

Under the extreme vascular tension of gestation, blood-extravasations are not uncommon. As we have seen in the history of abortion, the vascular tension most commonly finds relief by effusions from mucous membranes, and notably from the uterus. But occasionally blood-vessels in the lungs or brain give way. In the case of lung-apoplexy recovery may ensue, but sometimes rapid death occurs. When the extravasation takes place in the brain, the issue is generally fatal. The usual symptoms of apoplexy set in: coma, stertor, and convulsion; and commonly abortion attends, produced by the accumulation of carbonic acid in the blood. In such cases the death is much less rapid than when the blow falls first upon the heart.

Grenser 1 relates the case of a woman who, near term, complained of faintness and headache, then vomiting. Soon after this she became soporous, the pupils contracted, the pulse quick. In a few hours complete unconsciousness set in; the face became cyanotic; contractions, especially of the muscles of the neck, appeared; death followed in twenty-four hours. The child was extracted by Cæsarian section. A thick purulent layer was found on the dura mater and arachnoid. There was also hyperæmia of the brain and ædema of the lungs. How far the suppurative inflammation of the membranes of the brain was dependent upon gestation must be a matter of speculation.

We have known rapid, almost sudden, death ensue upon cedema of the lungs, and more especially when there was ordinary pneumonia or phthisis. In cases of lung-inadequacy, comparatively slight events that suddenly disturb the equilibrium of the circulation may prove quickly fatal. This mode of death is likely to happen in connection with albuminuria.

Thrombosis in pregnant women is rare, but several well-observed cases have been published. One was related by Edward

¹ Monatsschr. für Geburtskunde, 1865.

Smith, a skilled and keen physiologist. A woman, æt. 20, near term in her second gestation, after a hearty dinner, having exhibited excellent spirits, 'suddenly uttered a shriek, flung her arms about wildly, and cried, "Oh! my head; I cannot breathe; I am going mad! Give me my breath!" This continued for five minutes, during which time her hand was placed upon her chest. She became calm for a moment, and said to her husband, "There, Charles, I am better," and expired. The face was livid, and the body bent so that the knees approached her chin. Autopsy forty hours after death. The blood was black and fluid universally, except in the pulmonary veins, where the whole tube was filled by a cylinder of coagulum, having a central clot of blood enclosed by two layers of condensed fibrine, the outer one of which was colourless, and the whole so firm that it could be handled with impunity. The number of white corpuscles was much above the normal standard. The tissue of the heart, more particularly on the right side, was undergoing the first stage of fatty degeneration.'

Dr. Philipson relates an analogous case ('Lancet,'1865). A woman, æt. 35, in her first pregnancy, had been suffering from a slight bronchitis. In the act of answering the street door, she fell to the ground, and was dead in a few minutes. Autopsy: Dark blood flowed quickly on incision. The right auricle was full of black blood of the consistence of soft jelly. The blood in the venæ cavæ was very dark and fluid. In the right ventricle was a fibrinous mass, which extended through the pulmonary artery, and its right and left divisions, as far as they could be traced in the lungs. The concretion in the ventricle was very firm, spirally laminated, firmly adherent. A fatal case of embolism recently occurred in St. George's Hospital. The subject, about eight months pregnant, died suddenly. An embolon from a varicose vein in the leg had lodged in the pulmonary artery.

Sudden death during labour is more common than during gestation. The same conditions that lead to death during gestation may exist when the woman is overtaken by labour; and the enormous strain of labour will then act with redoubled force. We need not do more than note the rapid deaths that ensue from uterine hæmorrhage, external and internal, or from

rupture of the uterus. In these cases the fatal issue, although often rapid, is rarely quite sudden.

A very striking cause of death is *shock*: a combination of mental, emotional, and diastaltic force, under which the heart may be paralysed. During labour the contraction of the uterus, the closure of the glottis, the fixing of the chest-walls, combine to throw increased pressure upon the heart and brain. Sometimes, as Marshall Hall and Tyler Smith insisted, acute pain extorts a cry, the glottis is opened, the strain is taken off, and rupture of the uterus, extravasation in the brain or in the lung, or paralysis of the heart is thus averted. But, if not saved in this way, the patient is in imminent danger, especially if there is an unsound link in the physiological chain. Thus, the heart readily fails if it be degraded in texture or work, or if the blood be poor.

Pain alone, perhaps, may kill. The shock attending pain may suddenly paralyse the heart.

Allied to shock is syncope, which has proved fatal.

The more severe injuries, as inversion or rupture of the uterus, may kill more or less suddenly.

The lungs may be damaged under the strain of labour. We have seen severe emphysema ensue, ending fatally.

Cerebral apoplexy has in several instances occurred during labour. Robert Barnes related an instance to the Obstetrical Society. The woman of about forty years old was in her seventh labour. Convulsion, stertor, and syncope set in before the expulsion of the child. The child was expelled alive. The mother died twenty minutes afterwards. A small clot, quite recent, was found in the left thalamus opticus; and another, larger and of a dissecting character, in the left crus cerebri.

If there is pre-existing mitral disease sudden death is the more probable. Fritsch 1 says this is due to the paralysing effect of the sudden flow of a strong stream of blood into the right heart, caused by increased vascular tension. Panum showed that a sudden jet of blood propelled into the right heart does paralyse it.

Entry of air into the veins and heart.—Sudden death may result from this accident. After labour, the uterus being relaxed, and the patient inclining forwards, under the combined

¹ Arch. f. Gynäkologie.

influence of bagging forward of the uterus, the want of contraction of the abdominal walls, and atmospheric pressure, air may be drawn into the uterus, and thence sucked in by the open mouths of the veins. Carried to the right ventricle, the circulation and action of the heart are so disturbed that rapid death may ensue. It is, however, certain that the entry of a moderate volume of air is not necessarily fatal. Another way in which air gets into the veins is when foul air is generated in the uterine cavity as the product of decomposition.

We eite a case from Olshausen 'as a good clinical illustration. A 2-para of robust frame, æt. 29, was at term. The uterus was unusually distended. No albuminuria. Labour being lingering, the uterine douche was used, the water being at 30° R.; it was forced into the vagina gently. After eight minutes use the woman complained of oppression; the tube was withdrawn. The woman rose in bed, immediately fell back senseless, and died in a minute, at most, under convulsive respiratory movements, and distortions of the face. Eight minutes later bleeding from the median vein was tried, but only a few drops flowed. On touching the body, distinct and widely-spread erepitation was felt. Autopsy eight hours after death. A large quantity of dark fluid blood escaped from the sinuses of the dura mater. The cerebral membranes were very hyperæmic; the lungs somewhat congested. The heart was lying transversely; the left ventricle was in firm contraction; the right quite soft, something like an intestine with thick walls; the coronary vessels contained a quantity of air-bubbles; the left heart contained scarcely any blood; the right held a little, it was frothy. The distended uterus crepitated everywhere under the hand. A number of vessels of medium calibre, immediately under the peritoneum, were plainly filled with air. The right broad ligament was strongly distended with air-bubbles, and this emphysema of cellular tissue extended from the broad ligament through the retro-peritoneal space to the inner side of the right kidney, and even below the liver to the vena cava ascendens. This vessel was enormously distanted by a significant of the resolution. distended by air. The uterus being divided in the median line, a placenta was found attached to the auterior wall, a small flap being detached from the uterus; another placenta was

¹ Monatszehr, f. Geburtsk, 1864.

attached behind and to the right; a larger portion of this had been separated. The two ova were uninjured. Death, then, was caused by forcing air into the placental site.

N. Heckford published a case. A woman, at. 43, died suddenly in childbirth—her eighteenth labour. Labour commenced at 4 p.m.; a female friend, who alone was attending, said that after a few strong pains a living child was expelled, and the woman died immediately afterwards. There was no hæmorrhage, and the placenta had not been interfered with. The heart and blood-vessels were healthy. Both ventricles contained frothy blood. On making sections of the different viscera, air bubbled freely from the divided vessels; this was very conspicuous in the arteries of the brain. The case occurred in winter, and there was no decomposition. The greater part of the placenta was still attached, but at one spot it was detached. Air must have entered by the uterine sinuses.

Dr. More Madden relates ² a case of death from this cause.

Hervieux relates a case in which furious mania and death followed in thirty hours after an intra-uterine injection to correct offensive lochia. The air was collected and analysed. It consisted of oxygen, 7; carbonic acid, 11; and nitrogen, 82. That is, it was composed of the same elements as atmospheric air, but carbonic acid had replaced a part of the oxygen. In the same memoir ³ Hervieux traces the history of this complication.

Hall Davis related the following case. In extremely hot weather he was called to a case of retained placenta, adherent. The subject was a multipara, æt. 40, of full habit and congested features. There was no loss of blood; the labour, although protracted, ended in birth of a live child without instruments. Davis had just got his hand into the uterus to commence detachment of placenta, when the patient was suddenly seized with convulsions and died. No autopsy.

Similar cases are not extremely rare. Can they be explained on the theory of shock causing syncope, or by the entry of air into the veins?

Death may occur suddenly from hæmorrhage into the peritoneal cavity. More Madden cites a case of rupture of a

¹ Med. Times and Gaz. 1867. , ² Dublin Quarterly Journ. of Med. 1871. ³ L'Union Médicale, 1864. , ⁴ Obstetrical Transactions, vol. xi.

varicocele of the left ovarian vein proving rapidly fatal. Jacobi ¹ showed a preparation to the Berlin Obstetrical Society from a woman who had died suddenly after a normal labour. Under the peritoneal eovering of the uterus was an extravasation of blood near the two very varicose uterine plexuses.

Tetanus may cause sudden or rapid death. The subject has been referred to in the history of the Diseases of Gestation (Vol. I. p. 376). In addition to the authorities there eited, Dr. Gordon² gives instructive faets. In three eases tetanus came on during abortion. He eites a fourth from Dr. Storer After labour at the seventh month, an attempt made to detach adherent placenta provoked tetanus, which terminated fatally next day.

Sudden death in puerpery is far more common than during gestation or labour. Some of the predisposing causes are continued from gestation, and new ones are superadded. Thus, the woman who has gone through the perils of gestation and labour not wholly unscathed, is more likely to sink under the fresh trials of puerpery. Of these the most frequent, perhaps, is thrombosis, attended or not by embolism. The history of this affection, so full of interest, will be traced in a succeeding ehapter.

Death may occur suddenly at various periods down to three and four weeks after labour. In some cases the catastrophe falls with startling suddenness. A woman has gone through labour and two or three weeks of puerpery in the happiest manner, when, without a moment's warning, in the midst of cheerful conversation, on some slight effort she is seized with sudden sense of oppression, gasps for breath, cries for air, feels faint, and falls back dead. In some cases of this kind autopsy has revealed no adequate explanation. In such cases we are driven to the hypothesis of syncope. In other cases dissection has revealed embolism or thrombosis in the pulmonary artery.

Spiegelberg relates a case of sudden death on the third day from rupture of the left ventricle; there was myoearditis.

Sir J. Y. Simpson relates three cases of sndden death in which the splcen was found ruptured. In one the subject sank shortly after labour at the sixth or seventh month. There was

Monatsschr. f. Geburtsk. 1866. ² Amer. Journ. of Med. Sc. 1866.

found laceration of the enlarged spleen, and blood in the peritoneal cavity. In a second case, a woman, after making unusual exertion a week or two after labour, complained of abdominal pain, sinking, and died. There was rupture of the spleen. Dr. Cunningham delivered a woman by forceps. She died in an hour or two. The spleen was found ruptured.

Shock may not kill at the time of labour, but the blow may be so severe that the system is left shattered. Slight depressing causes will then act with fatal force. The mental agony that waits upon illegitimate maternity is sometimes enough to extinguish life. Of this we have known several sad examples. We have seen a woman die the day after labour from sheer grief and shame. Under the term 'Collapsus post partum' Baart de la Faille has collected thirteen cases of sudden death, four of them quoted from Ramsbotham.

Many examples of sudden death from thrombosis and embolia are scattered through the medical journals, and in various other publications. O. Van Franqué relates 2 three cases. In one, death occurred suddenly on the fourth day after labour, preceded by difficulty of breathing for three minutes. Fibrinous vegetations were found on the mitral valves; a complete adhering clot in the right pulmonary artery. In the second case there had been hemorrhage during labour and artificial detachment of the placenta, syncope, anæmia; on the ninth day pain occurred in the right leg in the course of the veins; this pain subsided, and on the sixteenth day dyspnæa, præcordial pain, and death occurred. There was cedema of the lungs and a complete thrombus in the pulmonary artery. The veins of the right leg were filled with clots. In the third case there had been disease of the veins of the left popliteal space during pregnancy. In the third week after labour sudden dyspncea was followed by death in an hour. There was cedema of the lungs; the right pulmonary artery was filled with a thrombus; and there was thrombus in the veins of the left popliteal space. Van Franqué concludes that acute œdema of the lungs is the cause of sudden death.

Hervieux ³ relates several cases. We cite one as a useful

¹ Monatsschr. für Geburtsk. 1865.

Wiener Med. Halle, 1864, and Monatsschr. f. Geburtsk. 1865.

³ Guzette des Hôpitaux, 1865.

illustration. A 2-para, æt. 40, admitted into the Maternité, had repeated shivering, ædema of the legs, and died suddenly. There was metritis, abscess of the broad ligaments, metastatic abscess of the spleen, hypertrophy of the liver, granular infiltration of the kidneys, pleurisy, ædema of the lungs. Another patient, æt. 44, died from meningeal hæmorrhage.

patient, et. 44, died from meningeal hæmorrhage.

Death may occur suddenly from entry of air into the veins in the puerpera. We found a large quantity of air in the heart and vena porte of a young woman who died after

convulsions from albuminuria.

Hervieux says that sudden death may ensue upon the first shock or other influence caused by the entrance of septic poison into the circulation. We believe we have seen cases that might be explained on this hypothesis, although it may be suspected that the poison acts by causing thrombosis.

Reus.—We have known sudden or rapid death to occur from

Reus.—We have known sudden or rapid death to occur from intestinal obstruction. In one case all the symptoms of intestinal obstruction arose, but after death we failed to trace the seat of obstruction. We could only conjecture that there had been pressure upon the large intestine by the uterus, and a local paralysis. In other cases a constriction has been caused by a band of inflammatory effusion. Where vomiting, especially stereoraceous, rapid distension, constipation, and collapse threaten, the question of opening the abdomen to search for the seat of obstruction must be considered.

Amongst the accidents that follow upon labour we have to note spontaneous inflammation of varicose veins of the legs. M. Nivert, in a memoir under this title, says suppurative phlebitis may become encysted, and so the pus may not enter the circulation; on the other hand, free suppuration may lead to purulent infection. These cases are intimately associated with phlegmasia dolens and septicæmia, and only call for commemorative mention in this place.

Another accident, also allied to poisoning, is the so-called putrescentia uteri. It has been carefully described by Böcr, Wengel, Jörg, Carus, Romberg, Schönlein, Von Sicbold, Rokitansky, Virchow, Klob, and others. Klob's views may be taken 2 as summarising the opinions of other observers. He describes

¹ Archives gén. de Méd. 1862.

² Patholog. Anatomie der weiblichen Sexual-Organe, 1864.

it as the 'highest degree of endometritis. The walls are generally imperfectly contracted, thin, often showing red discolouration on the peritoneal aspect. The uterus rises high in the abdomen, and is generally turned to one side. The mucous membrane is brown, dark, shreddy, stinking. On section the submucous tissue is often found changed to an ash-coloured slough. The placental seat is generally the seat of a deep suppuration; the thrombi have mostly fallen; the ends of the veins are in shreddy necrosis; between them and in them is a chocolate-brown sanious fluid, purulent masses, or thick pus. Frequently the necrosis spreads deeply into the proper uterine substance, so that the inner surface shows deep excavations, and the muscular tissue is necrosed. The destruction may extend in places to the peritoneum, which may even be perforated.'

Rokitansky and Virchow called some cases of this kind 'Erysipelas malignum puerperale internum.' They mostly occur in hospitals, and our own observation leads us to look

upon them as aualogous to hospital gangrene.

Scharlau¹ relates a case in which a perforation of the uterus attending this kind of necrosis opened into a perforation of the intestine. It resulted from a very protracted labour terminated by cephalotryptor. There was laceration of the vagina, starting of the sacro-iliac joints, pus on the articulating surfaces, denudation of the pubic bone opposite the rent of the vagina. Thus it appears that necrosis of the uterus may be caused by the crushing of violent labour, and the attendant alteration of blood and nervous exhaustion.

Strangulation of an umbilical hernia may follow labour, as in a case recorded ² by Mr. Bracey. Recovery followed operation.

Remanent Lesions and Diseases from Gestation and Labour.

The history given of the physiological and pathological processes of Gestation and Labour includes much of what, in strict sequence, would be described in this place. It will be sufficient here to give a systematic enumeration of the remancht lesions and discases, filling up the gaps and imperfect descriptions of preceding chapters, and stating some guiding and connecting general propositions.

¹ Monatschr. f. Geburtskunde, 1866.

² British Med. Journ. 1882.

Amongst general propositions the following may be stated:—1. Every tissue and every organ has been tested under high pressure—that is, both as to the integrity of their elementary components, as to their perfection of construction, and as to their working capacity.

Few women go through the trial altogether scathless. Traces of the damage sustained in the struggle will commonly be found in some organ or tissue. These may be classified as follows:—

A. Some of the physiological exaggerations of organs and tissues described as arising during gestation remain. Some of these will be intensified by labour and puerpery, and labour and puerpery may add new disorders.

B. Some pathological diatheses or organic lesions, latent until gestation supervened, and evoked by that process, persist in evidence. These also may be further intensified by labour and puerpery, and new lesions and diseases may be evoked.

C. Traumatic lesions.

A. Physiological Exaggerations.

In the vascular system we find, anæmia; hypertrophy of the heart; goitre, exophthalmos; venectases, in the form of piles, or of varicosities on the legs and vulva. It is probable also that venous dilatations might be found in the abdominal and thoracic cavities and organs if they were systematically searched for.

The liver and kidneys may not recover entirely from the granular change started during gestation.

Paralysis of the bladder may be transitory, lasting not more than twenty-four hours, or persisting for days or weeks. We have known it to last for several years. It is mostly the result of the shock, the exhaustion of labour. The nervous energy has been used up, and until a fresh store has been produced, the bladder, like the uterus and intestines, are without the due supply. It is not uncommon to find that from this cause, for a day or two the bladder refuses to act. The obstetrist should always have a catheter in his pocket, and not wait too long before using it, for should the bladder not empty itself, the accumulation distending the bladder tends still

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further to paralyse it. Sometimes the bladder will act with the bowels. But if there is still on the second or third day retention, or dribbling, which means retention (as explained under 'Retroversion of the Gravid Uterus,' see Vol. I.), we must seek the cause or associated conditions. These may be retroflexion of the large uterus, distension of the uterus by a clot, loading of the rectum, fever; or the retention may be apparent only, the real condition being non-secretion.

Grenser describes 1 twenty-five cases caused by swelling of the neck of the bladder. One case lasted fourteen, another seventeen, days. The loss of power is rarely permanent. Rest, and keeping the bladder relieved by catheter, will commonly bring recovery in a few days. If it persist, examination should be made to ascertain if the uterus is in due position. We have known retroflexion of the enlarged uterus after labour keep up retention of urine. To hasten recovery, Faradisation is very effective.

Whenever there is any doubt, pass the eatherer. This, if even superfluous as treatment, is of diagnostic value.

Sometimes allied to paralysis of the bladder is *Cystitis*. Chronic cystitis occasionally follows labour, and this origin should be considered when studying the affection. Dr. C. Monod has written an excellent monograph (1880) on the subject. His conclusions are: that it may arise from pressure of the gravid uterus, and from the hyperæmia which the bladder shares from proximity to the uterus; that there is an acute cystitis belonging to the beginning of gestation; that there is a form of cystitis beginning after labour, properly called post-puerperal.

In like manner there may be temporary paralysis of the bowels. Their function being less urgent than that of the bladder, the disorder is not forced upon our attention. The bowels ought to be emptied by an aperient, if required, before labour; and commonly the rectum at least is emptied during the expulsion of the child. Then it lies quiescent, perhaps for several days, unless made to act by an aperient or enema. If there is evidence of accumulation of fæces, a warm soap-and-water enema should be given, as well as an aperient. If the bowels fail to act on the second day, an aperient should, as a

¹ Monatsschr. f. Geburtsk. 1865.

rule, be administered. The action of the bowels provokes the uterus and bladder, and thus the three pelvic organs being unloaded, the course of childbed is made smoother. During the first action of the bowels a clot is frequently cast from the uterus.

We have seen death from ileus after labour as well as after ovariotomy.

The stomach and the digestive apparatus commonly partake of the general debility or lassitude. This condition has to be considered in regulating the diet. The old fashion was to keep the lying-in woman on gruel and other thin slops for a week or more. There was reason in this; but the practice was carried beyond reason. Oldham was, I believe, the first to break down this routine. He recommended substantial feeding the day after labour. We can hardly begin too soon to supply the system with good material for nutrition. But still we must be governed by the tolerance of the stomach and the digestive capacity. For twenty-four hours, at least, the stomach will hardly bear solid food. It will either be rejected or provoke colic. We have seen serious mischief caused by over-early and over-much feeding.

We must remember that active absorption has hardly set in under forty-eight hours. There is a stage following labour in which the whole system is at rest, or craves rest. The great argument for early free feeding is, that if good food is not supplied the system feeds upon itself—that is, it is apt to take up noxious matter, to poison itself. The argument is well founded. Still we may defeat our object by free feeding before the system can turn the food to account.

Nervous affections attending or following upon parturition. The description of the Neuroses of Gestation in the first volume should be referred to as an introduction to the present summary.

Amongst the neuroses attending upon parturition is a group of paralyses. In this place we do not think it necessary to describe cases of cerebral apoplexy. This subject has been incidentally treated in the section on sudden death.

Paralyses of the special senses. We have already seen that deafness and amaurosis may follow on albuminuria during gestation. But a case narrated by Toynbee seems to show that

deafness may result from the shock of labour. He relates the case of a lady who consulted him for complete deafness of both ears. She had become more and more deaf after each succeeding labour. Thus she had never heard the voices of her younger children.

Paraplegia has followed labour—examples are given in Volume I. In most cases gradual recovery takes place. We have known the affection to be confined to one leg. In some cases it appears to be due to shock telling upon the spinal cord. We may suppose that the diastaltic function was excessively worked so as to exhaust the nervous centre. In one case, narrated by Robert Barnes, paraplegia followed epilepsy during gestation. The gestation ended prematurely, so the paralysis could hardly have been due to pressure. In some cases paralysis of one leg has been caused by the crushing of the crural plexus by the forceps or even by the simple pressure of the head in labour.

Brown-Séquard described paraplegia as arising from retroflexion of the uterus.

In some eases lameness is not due to paralysis, but to relaxation or stretching of the pubic and saero-iliae joints.

Hughlings Jaekson² reports a case in which hemiplegia of the right side and loss of speech followed flooding. There was no valvular disease.

Dr. Ball describes puerperal paraplegia very fully. He says it is more frequent after parturition, but that it sometimes occurs during gestation.

The puerperal state has an unfavourable influence upon the functions of the spinal cord: 1st, weakness which pregnant women so often feel in the legs; 2nd, aggravation of the paralytic symptoms in women who become pregnant after being

paralysed. This we have seen is not constant.

When it supervenes in the puerperal state it is generally in primiparæ; but exceptionally it occurs for the first time in pluriparæ. When it has once occurred it is liable to recur. The development of the disease is generally slow, insidious; the patients feel weak in the knees, and feel a tingling sensation in the tips of the toes. By degrees these symptoms increase, and paralysis sets in. Only one limb is paralysed at first; at length

Lumleian Lectures. ² London Hosp. Rep. vol. i.

both become paralysed, and in several cases the bladder and rectum are affected.

In some cases the invasion is sudden, and the progress very rapid. Paralysis of both limbs may be complete in one or two days, and in severe cases the upper limbs become paralysed, the respiratory function is affected, and death rapidly follows. At post-mortem examinations, signs of acute meningo-myelitis, with abundant suppuration, have been frequently found; in other cases extensive hæmorrhage of the spinal cord has taken place. In one case the spinal cord was softened in the greater part of its extent. The sequelæ of puerperal paraplegia are not, however, so formidable in the great majority of cases; most recover in a few weeks or months, others remain crippled for life. In these latter cases there evidently exists an organic lesion. In the former the paraplegia must be attributed to reflex action.

The neurotic remanets, as deafness, amaurosis, aphonia, forms of paralysis or nervous exhaustion, have been studied in their connection with albuminuria in gestation; as also insanity (see Vol. I. p. 359). These disorders are also especially apt to follow severe hemorrhage.

The *uterus* is also liable to paralysis after labour. The condition known as inertia, so frequently associated with hæmorrhage, is a form of paralysis. It is mostly temporary. But a minor degree, which might be described as defective tone, may persist for an indefinite time. It is, we believe, one of the factors of subinvolution. It is certain that when active contraction of the uterus sets in and is sustained after labour, there is little risk of defective involution.

We have seen several striking examples of enduring paralysis of the uterus. The organ remained large, even in cases where it was not retroflected; the subjects were liable to menorrhagia, resisting all ordinary treatment, general and local. It was associated with paralysis of the bladder, so that in one case the catheter has been resorted to habitually for several years. In this case aphonia also complicates; and there is general defect of muscular power. In another case the bladder refuses to act at the menstrual epochs. In this latter case, improvement is progressing under the topical application of Faradism.

To obviate this condition is one of the reasons why we systematically prescribe quinia, ergot, sometimes adding strychnia, after every labour.

In some cases, whether it be from paralysis of the ovaries or otherwise, amenorrhæa and sterility follow the labour. A condition associated with this was described by J. Y. Simpson as hyper-involution, as if the process of involution did not stop short at the point of elimination of the structures developed for the needs of gestation and parturition, but, passing the normal line, went on into atrophy.

Pigmentation arising during gestation mostly leaves some traces behind. The nipples, the lower abdomen, and the external genitals generally, if not always, retain in some degree the darker colour acquired. We have had under our care at St. George's Hospital a remarkable case of a young woman who, after being delivered of a syphilitic child, had pelvic cellulitis. Gradually dark-bronzing was diffused generally over the skin, more especially marked on the breasts, abdomen, external genitals, attended by peculiar languor approaching to hebetude. The condition forcibly suggested advancing Addison's Disease. When put under iodide of potassium, a marked paling of the skin and general improvement quickly took place.

This case strengthens the argument already stated in favour of subjecting the suprarenal glands to careful examination on every opportunity in women dying in gestation and puerpery.

B. Pathological Diatheses and Organic Lesions, Evoked or Intensified.

It is not always possible to draw the line between the cases which apparently fall under this head from those which more obviously fall under the head of physiological exaggerations. They dovetail or overlap.

Foremost amongst the diatheses evoked are the strumous, tubercular, and neurotic. Struma is revealed in mastitis, pelvic inflammations, protracted discharges.

Tuberculosis is revealed by similar conditions, and further

by the aggravation of lung-mischief.

The neuroses—insanity, chorea, epilepsy, ague—have been discussed in the History of Diseases of Gestation.

The heart. Where heart-disease, especially hypertrophy, previously existed, it is almost certain to be aggravated by gestation and labour. Associated conditions, as exophthalmos and goitre, become intensified.

The liver and kidneys. The same may be predicated of

these organs.

The lungs. The relations of phthisis have been discussed in the History of Diseases of Gestation. Bronchiectasis, if previously existing, becomes aggravated. But it may be produced, or the foundation for it laid, during the violent straining of labour. This is more likely if ergot have been given. Emphysema is sometimes associated in this way with bronchiectasis. We have seen striking instances of this produced by ergotic labour. Some of the over-distended air-vesicles give way; air spreads rapidly in the connective tissue, extending from the lungs to the neck and even to the chest.

C. Traumatic Injuries.

The *skin*. Under the rapid stretching of the skin of the abdomen during gestation, the tissues, unable to keep pace by growth, give way. The '*strice gravidarum*' result. These have been described in the History of Gestation, Vol. I. p. 294.

We may here repeat the conclusions there set forth: (1) that the presence of striæ is a frequent remanet of gestation; (2) that their presence is not absolute proof of present or past gestation; (3) that their absence is not proof of nulliparity.

Striæ are sometimes formed on the breasts.

Separation of the recti abdominis muscles sometimes takes place during gestation and labour. This may occur at the umbilicus, or along the linea alba. In either case this separation may give rise to hernia, made evident under straining or expulsive efforts. This condition is sometimes called 'Eventration.' When it exists, it must be counteracted by a well-devised belt.

Pendulous belly. With or without separation of the recti muscles, the abdominal walls may become so relaxed after one or several labours as to lose all tone and power of supporting the intestines. The belly hangs down over the pubes; and in the event of another pregnancy the growing uterus, ill-supported, bags over, and there results a form of dystocia, which will be described under that head. To obviate this it is extremely desirable to supplement the defective functions of the abdominal walls by wearing a firm binder. Under the influence of this aid, the muscles and other constituents regain some of their lost power.

The uterus and perimetric structures. Fissures of the neck not healing may entail subinvolution, endometritis, ulceration, menorrhagia, perimetritis, sterility (Whitehead, Emmet), and even paralysis of the organ.

The vagina remaining relaxed, there ensue prolapsus in the form of rectocele, cystocele, uterine displacements. If there have been sloughing, fistulæ and cicatricial contractions result.

The *perinœum* may also lose its firmness from over-distension or laceration. This weakness may indirectly favour prolapse of the uterus, since the floor of the pelvis is impaired. The vulva also unduly stretched, and the sphincter injured, the retentive power of the lower part of the abdominal cavity is weakened.

Occasionally sloughing or gangrene of the vulva follows labour. We have observed it after scarlatina and diphtheria. Chavanne described an epidemic of this affection. Humbert describes a similar epidemic at the Charité in Paris. Dubois, Otto, relate similar instances. All these occurred in hospitals. They may be compared to hospital gangrene in surgical cases. Some arc due to erysipelas. Dr. Herman has collected valuable records bearing upon this subject.

Evidences of past gestation, of nulliparity, and of virginity.

It is convenient to consider first the evidences of past gestation, since these consist of positive signs, whilst the evidences of nulliparity and virginity mostly consist in the negation of the positive signs of gestation.

A. Evidences found in the living.—1. Of completed gestation and labour at term. 2. Of incompleted gestation, of abortion or premature labour, recent and remote.

¹ Gazette Méd. de Paris, 1852. ² Archives de Tocologie, 1876. ³ Obstetr. Trans. 1883, vol. xxv.

A. In the Living. Recent and remote.

Some of the conditions enumerated in the preceding section, Remanent Lesions and Diseases.'

1. In the recently delivered at term. We find in the breasts: fulness, perhaps hardness, secretion of milk, darkened areola, prominence of tubercles.

In the abdomen the skin and abdominal walls lax, flaccid; the striæ and pigmentation still marked. The uterus is enlarged, as determined by bimanual examination; the cervix is soft, fissured, gaping, open, generally admitting the finger; mucopuriform discharges, perhaps tinged with blood, escaping; the vagina large, flaceid, with free mucous secretion; the perineum lax or gaping, torn at the fourchette or beyond. Within the first week, these signs are especially marked; with the exception of the milk secretion, they tend to subside after a month.

During the first few weeks, the speculum will reveal a more or less intense red 'raw-looking' aspect of the vagina and vaginal-portion, due to the process of restoration of the mucous membrane after the contusion of labour; more or less epithelium-shedding; and round the os externum there is almost invariably a circle of abrasion, with prominent villi from shedding of the epithelium at the part which bore the chief brunt of the bruising during the passage of the head.

2. The signs of recent abortion. The chief signs are: soft, relaxed vagina, free mucous secretion, enlarged uterus, dilated os, added to the 'remanent conditions of early pregnancy.'

The evidence of remote abortion is too uncertain to justify a positive opinion. But usually, as after labour at term, the vagina has lost much of the contractibility and rugosity of virginity.

Nulliparity. The negative evidence consisting in the absence of the usual remanent conditions of gestation. The positive evidence consisting in small, smooth, conical vaginal-portion, especially with minute os externum; with this there may be the lax vagina and vulva, indicating sexual relations. The fallacies are, however, important. First, we have known delivery at term to be followed by a condition of cervix and os externum that could not be distinguished from the virgin characters. The lax vagina and perinacum may have been produced by sexual intercourse or masturbation.

Virginity. Negative: absence of the remanent conditions of gestation. Positive: the presence of the hymen, a narrow, contractile vagina, persistence of the rugæ, a small smooth vaginal-portion and os uteri. Amongst the fallacies are: Surgical treatment or accident may have removed the positive signs; the hymen may survive sexual intercourse, gestation, and labour, whilst its absence does not disprove virginity.

B. In the Dead. Past pregnancy at term. Recent, that is, within a month or whilst involution is going on. In addition to some of the signs enumerated as evidence of recent delivery in the living, there is the corpus luteum in the ovary tending to cicatrisation, the weight of the uterus exceeding 1,200 grains, its length exceeding three inches; the anterior and posterior walls not in such close proximity as in the nulliparous uterus, the posterior wall more bulging, the fundus between the angles arched and rounded, perhaps peritoneal rugæ, mostly transverse on posterior wall near the lower portion; the uterine sinuses visible, some with clots or thrombi in them, breaking up; the mucous membrane not fully reformed, a line of demarcation at the os uteri internum; seat of placenta still marked as a projecting surface; the cervix still large, the arbor vitæ less distinct, free secretion, recent laceration of the os externum, generally on the left side; ecchymosis of the vaginal-portion; serous effusion in the pericervical connective tissue. The vagina is lax, the ruge are somewhat smoothed out, remains of ecchymosis, free epithelium-shedding. The perinaum shows the recent wound of the fourchette or beyond, and probably ecchymosis and ædema of the labia vulvæ will be

The breasts are enlarged; milk is found in the lacteal ducts.

After a month, the involution-process being completed or nearly so, the above signs are less conspicuous; the arched fundus uteri remains; the vaginal-portion commonly remains fissured in lobes, thickened; the perinæum may show cicatrices. The seat of the placenta may be traced for some time longer.

In the living and dead some fallacies have to be considered: Surgical treatment may account for fissure of the vaginal-portion; the removal of large fibroid tumour or polypi may leave the uterus enlarged.

The *linear albicantes* or *strice* have been already discussed as to their significance.

After recent abortion. The corpus luteum showing a cavity and surrounding vascularity according to the lapse of time from conception. The tubes, ovaries, and uterus show vascularity; the mucous membrane of the uterus exhibits a roughened surface from shreds of decidua; a serous or sero-sanguineous secretion bathes the uterine cavity and the tubes. The uterus is above the normal weight and size. The vagina is lax.

CHAPTER VIII.

ACCIDENTS OF PUERPERY—ACCIDENTS OF LACTATION: DYS-GALACTIA; AGALACTIA; GALACTORRHŒA; CONGESTION WITH MILK; GALACTOCELE; MASTITIS; ABSCESS OF BREAST.

THE student is advised to refer back to the section on the Anatomy of the Breast (p. 188, Vol. I.), and to the chapter on the 'Puerperal Process' (p. 54, Vol. II.), as a preparation for the study of this subject.

We have several times pointed out that a considerable proportion of mothers are not able to fulfil the last stage of the work of reproduction, that of suckling. The woman may have struggled through gestation and labour with tolerable success, but she can do no more. The breast-glands, which are really part of the glandular system of the skin, share in the want of development of this tissue, and in the general defect of glandular development throughout the body. Hence, when the call comes for the breasts to enter upon duty, one of these things happens: first, there is total or almost total failure to secrete milk: agalactia; or a futile attempt is made; the breasts become engorged; for a few days, perhaps, a scanty supply of milk is secreted, and then it stops; the breasts become flaccid, and 'dry up'; the function has failed: this is another form of agalactia. Can anything be done to stimulate the secretion of milk when deficient? Generous diet, tonics, codliver oil should be tried, on the general principle of nourishing the patient. The woman is in danger of being over-plied with stout. Certain special means are vaunted. Amongst these is the application of the leaves of the castor-oil plant. We have little faith in it. Another is persistent rubbing, with constant drawing of the breasts by the child or the pump. Some other agents are credited with galactogogic virtue. do not discuss them, because we believe that milk-secretion depends upon, first, healthy nutrition of the woman, secondly, upon the development of the breasts and other glands. If one or other or both these conditions fail, it is a sin against physiology to endeavour to force secretion, after having given a fair trial of ordinary means, as good diet, gentle frictions, and drawing of the breasts. To excite the system and the breasts beyond this is to good them beyond their capacity. It is like digging spurs into a jaded horse. It irritates and wears the woman, and may cause inflammation and abscess of the breasts. Or, again, the secretion of milk sets in with a rush; the breasts become greatly engorged with milk and blood; the milk escapes imperfectly, part being retained in the ducts, the excretory orifices being more or less obstructed.

Ratzenbeck says that a duct may be obstructed by accumulation of epithelium, and that this may be recognised by a very minute, white, projecting, translucent vesicle.

In some cases, again, the secretion is excessive and is freely excreted, more than sufficing for the child, and overflowing: galactorrhæa.

These three deviations from the healthy type may be said to be forms of dysgalactia.

In some cases, the breasts may be overpowered by the task imposed upon them. Engorgement leads to inflammation: mastitis; and mastitis commonly ends in abscess; sometimes, however, in resolution.

We must trace briefly the history of these events. In healthy women, capable of nursing, the flow of milk sets in on the third day. For the first day after labour no marked change in the size or firmness of the breasts is observed. In many cases, it is true, a little milk is secreted during gestation. This is evidence that the glandular structure is preparing for its function. But it is only when the uterus has accomplished its work, when the blood-current is turned off from the pelvis and determined to the new focus of energy, that the breasts start on active duty. On the second or third day there is almost invariably a marked enlargement of the breasts; they become harder and more prominent. There is active hyperæmia or determination of blood to these organs—a condition always observed in glands called upon to secrete. So far, then, the process is perfectly normal; and, on physiological reasoning, we should

not anticipate any degree of febrility, any more than we should from the hyperemia of the stomach and digestive glands after a meal. But it is a matter of observation that on the second and third day the pulse and temperature often rise; this is attended or preceded by a slight tremor or rigor, which is followed by thirst, and perhaps by perspiration. These symptoms mark the so-called *milk-fever* or *ephemera*. In a day or two, when the milk flows, this febrility subsides.

Now an important pathological and clinical question arises: Is this febrile movement really due to the milk-process? Is there, in short, such a disorder as milk-fever? Fordyce Barker says that, under proper care, milk-fever is an exceptional incident. Winckel denies it. The observations of Fancourt Barnes, made with great care in the British Lying-in Hospital, also answer this question in the negative. These observations show that in most puerperæ in healthy conditions there is no rise of pulse or temperature attending the establishment of the milk-secretion; and that where such rise occurs it may be traced to defective hygienic conditions: errors in diet, emotional disturbances, sepsis, or hospital influences. This, then, is what fever means: something wrong in the surroundings or in the internal organisation of the patient. When rise of pulse and temperature is observed in more than one patient in a hospital, it strongly suggests that something is amiss in the hospital construction or administration. This something may be direct heterogenetic infection, or such disturbing influence of the excreting capacity of the patient as to favour autogenetic poisoning.

Believing as we do that milk-fever means obstructed excretion and a form of toxemia—slight, it may be—we may describe the symptoms of the affection which passes under this name as follows: slight rigor, headache, flushed face, furred tongue, thirst and loss of appetite, heat and dryness of the skin (the temperature rising to 100° or 101° F.), quick pulse (100 or more), painful and distended breasts, sometimes to the extent of embarrassing respiration. These symptoms commonly subside within twenty-four hours.

Milk-fever may be prevented in most cases by careful attention to the hygienic conditions of the puerpera; by vaginal injections of hot water, carbolised or simple; by

securing rest after the labour; by giving nutritious diet; by applying the child to the breast on the day following labour, before the engorgement has set in; relieving the bowels by a saline purgative; by giving the tonic antiseptic mixture of quinine, ergot, and digitalis. Dover's powder is sometimes useful. Gentle friction of the breasts from the circumference towards the centre may also be beneficial. If the fever persist beyond twenty-four hours, it becomes puerperal fever.

Mastitis. Inflammation is apt to occur in any gland or tissue when, during the first impetus of physiological activity, some disturbing influence, as cold, violence, or obstructed excretion, intervenes. This is the more likely to happen in women of a strumous diathesis. A strong predisposing cause is hæmorrhage at the time of labour.

Amongst the immediate causes are: persistence in applying the child or the breast-pump too soon after labour—that is, during the first twenty-four hours, before milk is secreted; injudicious friction of the breasts; the presence of cracks or fissures in the nipples; imperfect development or flattening of the nipples. When these two latter conditions exist, attempts to suckle are especially apt to cause inflammation. The openings of the galactophorous ducts may be obstructed; then engorgement in the ducts and in the proper glandular tissue entails hyperæmia; hyperæmia easily passes into inflammation, and inflammation into abscess.

There are three kinds of abscess. The first kind is superficial; its seat is between the skin and the superficial surface of the gland. It is generally rapid in its course; the constitutional disturbance is not great. It 'points' soon. The second kind is the true glandular abscess; it involves one or more masses or lobes of gland tissue. The symptoms are severe. The great stretching of the parts—the pus collects within the fascia of the organ—induces agonising pain, throbbing, and enlargement. It is commonly attended by fever. After a time it 'points.' The third is the submammary. Its seat is the connective tissue behind the gland. It is slow in progress; the breast proper is often free from implication; the constitutional reaction comes late; the pointing is slow. This form presents a remarkable appearance. The breast is pushed forward by something behind it.

The breast is far from being affected equally or uniformly. One or more lobes may be seized, whilst others remain free and continue their function of secreting healthy milk. One breast only may be attacked. Nunn has drawn attention to the fact that the lower segment of the gland is twice as liable to be the seat of suppurative inflammation as the upper. This is explained by the lower segment being dependent, and there, the seat of passive congestion, the blood and the milk are disposed to stagnate. This fact points to the principle of the treatment, prophylactic and curative, of supporting the breast from below. The two breasts appear to be equally liable.

The time when abscess occurs is, in the majority of cases, within the first two months—more especially within the first. Nunn, analysing 58 cases, expressed the following formula: If we assume the liability to inflammation during the first two months to be as 4, then the liability during the following seven months collectively falls to 1, and for the period after the ninth month it rises to 2. The deductions from this are that, when the breasts have proved their capacity by undisturbed work during the first two months, there is little to fear; and that the inflammations which threaten after the ninth month are the result of over-lactation, and ought to be averted. Accepting this latter proposition, the chief study must be directed to the prophylaxis of the inflammations that arise during the first two months.

Hyper-lactation. It is convenient—although in opposition to chronological order—to dispose in the first place of the inflammations of protracted lactation. What constitutes protracted lactation? The question hardly admits of a definite answer applying to all cases. As in so many other problems, the capacity for lactation is relative, varying with the individual. We must, then, seek for the signs which denote that the term of lactation has reached its limit. It is perhaps generally true that a healthy woman may safely suckle for nine months; some go on without obvious distress for a year, but few exceed that period without damage. A sense of weariness, of weakness, creeps on; the yield of milk falls off in quantity and quality; it becomes thinner, more watery; the proportion of oil-globules is smaller (see figs. 71, 72, Vol. I.). If, under these circumstances, suckling be persisted in, the system and the breasts

alike are strained beyond their powers, and a slow kind of inflammation of the breasts, easily merging into abscess, is very apt to set in. One almost constant sign of over-suckling is a weary, dragging aching between the shoulders. This is due partly to muscular weakness, partly to reflex action. Nunn shows that over-lactation leads to a spinal cachexia. This is marked by a peculiar dryness and chalkiness or opacity of the skin, drowsiness, loss of appetite, constipation, dyspepsia, incontinence of urine, physical and mental lethargy; the necessary task of weaning appearing to the patient to be one of in-surmountable difficulty. The breasts become preternaturally large and flabby, the peripheral portions of the lobes being most engorged. Various neuralgic troubles arise. In the section on Albuminuria (Vol. I. p. 391) we cited the description by Power of the loss of accommodation of the eyes and other troubles of vision; deafness, also, is apt to occur or be aggravated. In one case seen by us the woman, under excessive suckling, became liable to fainting-fits. She lived poorly, and was frequently overworked. One day, after dragging her infant for three or four miles, she went to bed much exhausted, and was found dead in bed. On autopsy, there were found general marks of anæmia; the blood itself was thin, scanty, and fluid.

Now it is obvious that these conditions—evidence as they are of exhaustion—indicate preventive treatment. If the system do not respond fairly to generous diet and tonics, no time should be lost before weaning. This course will be the more imperative if menstruation have returned, and if the child do not thrive.

We may now return to the subject of inflammation and abscess proper during the first two months after delivery.

Astley Cooper described the inflammation as adhesive in the first stage, suppurative in the second, and ulcerative in the third. This general proposition is of extreme clinical value. The glandular form of the affection is that which chiefly demands attention. One lobe after another may become inflamed, so that there may arise a succession of 'knots' and abseesses. These, bursting or being artificially opened, may leave sinuses obstinate to treat. Sometimes the ulcerative process cats across galactophorous ducts, and then milk as well as pus flows from the sinuses; these are especially difficult to treat. Sometimes

lobes of the gland, with connective tissue, become necrosed and form sloughs. In this way blood-vessels may be opened, and serious hæmorrhage result.

Depressed nipples. When the child is put to ill-developed nipples, sccretion being excited and excretion retarded, engorgement and inflammation are very apt to arise. This defect is often due to habitual pressure upon the nipples by ill-adjusted corsets. It is therefore one of the points to which 'hygienic dress' should be directed. During gestation, careful attempts may be made to draw out the nipples by a breast-pump or by the application of an exhausted soda-water bottle. But this plan must be adopted with great caution, lest premature labour be provoked. It should be commenced within twelve hours after delivery, so as to prepare the nipple for the first efforts of the infant.

Fissures or cracks may occur independently of erosion or ulceration. The smallest fissure, only seen on minute inspection, is enough to cause agony in nursing. Rest is the first remedy; this is materially aided by the lead nipple-shields; and, during rest, touching with nitrate of silver and covering with collodion are of service.

Inflammation of the nipple may occur simply or as an attendant upon erosion, fissures, or cracks. Eczema is a rare affection. The best general treatment, applying to all the described affections, consists in great care in washing away remnants of milk after nursing, then smearing the part with a salve made of liquor plumbi j., prepared calamine powder j., glycerine j., and vaseline vij.; then to protect the nipple by the lead shield; glycerine and tannin is often a valuable application. Suckling is often made endurable by making the child draw through an elastic tube fitted to a glass nipple-shield. Thus the direct dragging upon the sore nipple is avoided.

There are various forms of sore nipples. Erosion or excoriation consists—we cite Fordyce Barker—in a superficial wound of the skin, the epidermis being abraded by nursing. Sometimes there are little vesicles on the apex or sides of the nipple, which are broken by sucking; scabs form, and 'chapped nipples' result. Then the whole thickness of the skin is destroyed; this is ulceration. The surface then is bright red, granulated, frequently swollen, and grooved in fissures. Under

this state nursing is acutely painful. We have seen half the nipple eroded under this process. The best application is the nitrate of lead recommended by Wilson, of Glasgow. Barker's formula is nitrate of lead gr. x.-xx., glycerine 5j. We have used it with excellent effect. Care is requisite to wash off the lead before putting the child to the breast. In the early stage, after drying the surface with soft linen, it may be painted with the compound tincture of benzoin, or with collodion. Thus an artificial skin is provided, under which healing goes on.

But if the ulceration proceed, weaning must be promptly enforced. Not seldom a day or two of rest is enough; and then nursing may be resumed.

During the inflammatory stage of the glandular form there are nodulated indurations, 'lumps in the breasts,' rendering lactation painful, and often involving its suspension. This is the form which succeeds lacteal obstruction or engorgement.

In the cases in which suppuration, sloughing, and sinuses occur, there is commonly irritative fever, marked by chills, rigors, quickened pulse, loss of temperature, and exhausting perspirations. Vomiting and diarrhœa sometimes occur, indicating absorption of pus or ichor from the suppurating surface. Emaciation ensues. Delirium, even mania, have been recorded.

In connection with this fever there is a complication rarely, if ever, described. This is the puerperal condition. We are not dealing with a pure inflammation of the breast, but with inflammation accompanied and modified by the degraded blood, laden with the *débris* of tissues undergoing involution and struggling to be excreted. The breast should be an active participator in this work of excretion. If it fail, greater strain is thrown upon other organs, and the probability of waste-stuff being retained in the system is great.

The diagnosis is especially important as a guide to treatment. It is directed, then, to the determination of the stage of the affection. In the first or adhesive stage, the breast is swollen, but it is not often so tense as to present a shining aspect; there is no spot showing special discolouration, and fluctuation is not made out. In the second or suppurative stage, the appearance is characteristic. If the breast be com-

pletely bared, the prominence and tension, the glazed surface and peculiar bluish colour of the skin, in parts more or less thinned, constitute enough to reveal suppuration, even without palpation, to bring out fluctuation. The ulcerative or sloughing stage is too obviously marked to require special description.

Prognosis. The subcutaneous inflammation is of shorter duration than the other forms. It does not often last longer than a week or two after the abscess is opened. The subglandular variety is more insidious in its early stages, and lasts longer than the subcutaneous variety. It is usually more diffuse. The duration of the glandular variety is more protracted still. Different lobes being attacked successively, the affection is apt to drag on for weeks.

What is the influence of mastitis on lactation? Circumscribed inflammation of the connective tissue, the proper glandular tissue being free, may not arrest lactation. When the inflammation is diffuse, and the pus is discharged by several openings, the secretion of milk is usually arrested. But even in these cases the function may be restored after a while; and it may continue little disturbed in the other breast. Indurated masses may remain for some time after the abscess has closed. A few instances of death have been noted.

Treatment. The first question is as to the continuance of lactation. As a general principle, an inflamed organ requires rest. But the rest from functional work need not in all cases be absolute. In many cases the breast continues to secrete, although the child is taken away. This is especially the case in the subcutaneous and subglandular varieties. A modified degree or form of lactation may be necessary to prevent milkengorgement. This is commonly best performed by the careful use of the breast-pump, taking care to do no more than unload the disturbed tubes. Where one breast only is inflamed, suckling may, if not otherwise contra-indicated, be kept up on the sound breast.

Can anything be done to check inflammation, so as to prevent its passing into the suppurative stage? In healthy subjects this can sometimes be accomplished. We have seen sucking do marked good. During the early or invading stage,

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the administration of two or three drops of tincture of aconite every hour or two hours is very useful in reducing the impetus of the circulation. Painting the breast with iodine; the local use of warmth and moisture by poultices or water-dressings on spongio-piline. But poulticing is often carried to excess. Belladonna has enjoyed considerable vogue. Beyond allaying pain its utility is doubtful. The dorsal decubitus as an aid to rest is of great importance. The engorgement is much diminished by the easier return of blood from the organ, especially from the lower part. This object is also promoted by direct support. At this stage straps of plaster containing mercury, lead, and belladonna, so applied as to lift up the lower part of the breast and keep up gentle, uniform pressure, are of eminent value.

Frictions, so commonly employed, are of limited application. In our experience we have frequently suspected them to be the cause of inflammation and abscess. Some nurses are apt to practise this behind the doctor's back, looking upon the care of the breasts as their duty or privilege. And thus, whilst the doctor is pursuing, as he thinks, the principle of rest, his efforts are being constantly thwarted by rubbings. If strapping answer no other purpose than securing against this practice, the plan has an incontestable merit.

There is, however, a time when judicious frictions are useful. This is before inflammation has begun, during the stage of engorgement, and to help the breast in its first struggle to secrete and excrete. It requires a gentle hand. Light frictions should be made, beginning from the circumference, and extended towards the centre or nipple; the guiding idea being to help the retarded milk onwards along the ducts to their openings. Olive oil, containing a little extract of belladonna, may be used.

During the stage of suppuration the great question is as to the time of opening the abscess. Opened it certainly ought to be in the great majority of cases. Spontaneous bursting is a tedions process; the pus may be very slow in working its way to the surface, the skin resists a long time, and in the meanwhile the abscess is extending, involving fresh lobes, and, pent up, it burrows widely under the skin. The process of bursting is ulceration; and this process should be reduced to the minimum. Loss of skin by sloughing should be prevented; it is apt to leave an ugly scar. We should therefore meet the effort of Nature half way by opening the abscess. Yet it is not desirable to use the knife too soon. If we puneture before the proper moment, the knife must be plunged more deeply through tissues intensely vascular. Serious hæmorrhage may result.

Pending the proper opportunity for ineision, rest in the dorsal posture, and steady, not tense, support of the breast by a bandage or haudkerehief are essential.

The proper moment is indicated by the thinning and blueness of the integument, and the detection of fluctuation. The best instrument is a sharp-pointed tenotomy knife. The incision should be made antiseptically. A drainage-tube will be useful if the abseess be in the upper part of the breast. But generally evacuation of the cyst is best attained by regulated pressure, so adapted as to keep the deeper part of the cystwalls well in contact.

The principle of compression now finds its happiest application. It is best practised by using strips of mercurial and belladonna plaster about two inches wide, and long enough to seize the lower part of the breast, to pass over it, and to be made fast over the opposite shoulder. Beginning from below, and overlapping as we proceed upwards, pressure is made in the most effectual manner. An opening should be left at the seat of puncture. Occasionally a pad may be used next the skin, so as to fill up any depression and exert more direct pressure upon the cyst-walls. The best pads are Gamgee's disinfecting sponges. These sponges should also be used as a dressing to eateh the discharged pus, and should be frequently renewed.

The strapping need not be removed or changed for three or four days, unless very severe pain announces injurious pressure upon inflamed structures. The strapping, properly applied, is not, in our experience, open to the objection sometimes urged that it impedes respiration. The plan has long been in use. Robert Barnes learned its use and the method of applying when attending the clinique of Trousseau. Hardly anything in surgery has given us more satisfaction. It shortens the duration of the suppuration in a surprising manner, and is the surest of all antiseptic measures.

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When ulceration or sloughing has set in, pressure is still useful, but it must be applied more lightly. It may then be useful to paint the ulcerated surfaces with iodine or light solution of carbolic acid or chloride of zinc. We have found the old unguentum resinæ extremely beneficial. Nunn speaks very highly of the use of the galvanic current in the sequelæ of abscess, as sinuses, indurations, and ædema.

The constitutional treatment is of essential importance. It is based upon the known clinical principles. In the inflammatory stage, salines, aperients, and sedatives are indicated. When suppuration has begun, quinine, iron, sedatives are required. And throughout, the diet should be generous.

As a part of the treatment of mastitis, it sometimes becomes necessary to 'dry up the milk.' On this ground, as well as on other occasions, as in weaning, or when it is determined not to nurse, we have to inquire how best to effect this object. Belladonna has been credited with decisive power in this way. By some this power is denied. Braxton Hicks speaks highly of the efficacy of equal parts of extract of belladonna and glycerine applied to the breast, giving at the same time iodide of potassium in eight-grain doses. Tyler Smith extolled bromide of potassium.

To these means must be added saline purgatives and pressure upon the breasts. In cases of still-birth it is desirable to abstain from fluids.

CHAPTER IX.

THE PUERPERAL FEVERS.

No subject in the whole range of medicine is more fraught with interest than is this of puerperal fever. Hecatombs of women and children have been its victims, yet in the vast majority of instances it is emphatically a preventible disease. If smallpox, scarlatina, typhoid, erysipelas are ever 'stamped out,' then will puerperal fever, in so far as it is dependent upon these diseases, also be stamped out. Not alone in this way, but in many others, puerperal fever is indissolubly linked with the most important questions in general medicine. It cannot be rightly understood by those who look upon it simply as a disease that attacks lying-in women. Nor, on the other hand, can its mystery be penetrated by those who have not made a clinical and critical study of obstetrics. No mere specialist can grasp the subject. No pure physician or surgeon can fully realise it.

Of late years puerperal fever has been a frequent topic of discussion. In Paris, London, New York, and elsewhere, the leading societies have discussed the various questions connected with it; a vast amount of clinical experience, of erudition, and of critical acumen has been brought to the task of elucidation. And still we cannot be said to have arrived at settled conclusions.

The first and fundamental question: What is puerperal fever? or, Is there such a thing as puerperal fever? is still under debate. This will be the first question to examine.

Starting from this point, we shall trace the peculiar conditions in the puerpera which make what may be called 'the puerperal constitution.' We shall inquire whether this constitution may itself generate a fever, and then we shall have to study how this constitution acts when a specific poison is introduced from without; and still we must examine how other poisons, not of a zymotic type, act and are reacted upon.

Having studied these preliminary questions which lie at

the root of the question, we shall review the various theories of puerperal fever in the following order:—1. That puerperal fever is a disease *sui generis*. 2. That it is a putrid fever due to the absorption of foul matters from the uterus. 3. That it is the result of traumatism. 4. That it is a form of septicæmia, analogous to surgical fever. 5. That it is due to the invasion of the system by microscopical organisms.

In the next place we shall trace succinctly the characters of the best-marked forms of puerperal disease, as:—1. The excretory puerperal fever. 2. Pelvic cellulitis. 3. Pelvic or puerperal peritonitis. 4. Thrombotic puerperal fever, and the related history of thrombosis, venous and arterial. 5. Metritis. 6. Metro-peritonitis. 7. Putrid infection. 8. The cadaveric toxemia.

Then we shall study the relation of the zymotics to the puerperal fever—that is, of small-pox, scarlatina, erysipelas, typhoid, diphtheria.

We shall see that all these forms or varieties of fever are observed. And thus we are led to the logical conclusion that, if there be no such thing as one definite puerperal fever, we must recognise several puerperal fevers. The question then, Is there a puerperal fever? must be answered: Yes, in the plural number. Meigs saw this, and wrote of child-bed fevers. Arthur Farre took the same view.

We shall then examine the various modes of infection—that is, the sources and manner in which the morbific poisons are introduced. This will lead us to touch upon, 1. Epidemicity; 2. Convection by touch; 3. by air; 4. by clothes; 5. by microbes and other modes.

Then we shall describe briefly the anatomical characters found in other forms of fever. Then the pelvic inflammations and phlegmasia dolens which will have been pointed out in the special description of these particular forms.

Then we shall study the *symptomatology* of puerperal fever in its general relations, endeavouring to classify the symptoms with a view to the better appreciation of their significance.

Then, following the same principle of supplementing special descriptions by general deductions, we shall give a condensed summary of the *treatment*, prophylactic and therapeutical.

This section will close with a summary of conclusions, more or less absolute or provisional, such as legitimately flow from the facts and arguments presented.

The history of puerperal fever is almost eo-extensive with that of the history of medicine. We cannot pretend in this place to trace it even succinctly. Could we do so, we should find in puerperal fever the reflection of every doctrine prevailing in medicine from the days of Hippocrates. It must be enough to say that until recently the fevers of lying-in women were explained on the theory of solidism; and that the present prevailing theory is based upon the hypothesis that the evil lies in the fluids. At the same time it is useful to bear in mind that the most recent prevailing theories may be traced back to periods more or less remote, obscured indeed by different and perhaps erroneous doctrines, and the technical language of the day.

The term 'puerperal fever' was promulgated by Morton in 1718. The most ancient theory is that based upon the retention of the lochia and the decomposition of the placental products. Hippocrates and Galen, Boerhaave, Sydenham, Mauriceau, and Smellie, and most authors of the last century, supported this doetrine more or less confidently. Then there came the theory of milk-metastasis. Willis, Puzos, and many others upheld this. At the beginning of this century, Autenrieth set forth his physiological theory, which combines the two preceding theories. It may be thus stated: During gestation all the fluids flow specially to the uterus, but after labour they are eliminated by the sweat, loehia, and milk. these peripheral functions are interrupted, the course of these juices is determined to the head, chest, and especially the abdomen. This was widely accepted. Soon after this there came the gastro-bilious theory, upheld amongst others by

Then came the *phlogistic theory*. The disease consisted in inflammation, having its centre in the uterus, surrounding tissues, veins of the uterus and lymphatics, intestines and peritoneum; or it was peritonitis simple.

Then there was the theory of erysipelas, of hospital fever,

of putrid fever.

Robert Ferguson appears to us to deserve a foremost

place amongst those who have contributed to the establishment of the doctrines now most in favour. He showed by experiments and clinical observation how all the accidents of puerperal fever may be artificially produced by vitiating the blood. In puerperal fever there are two sources at least of blood-vitiation: 1. The direct insertion of noxious matter into a vein. 2. Mechanical injury to the solid walls of the blood-vessels. 3. And he contended that there was a third source by inhalation.

Is there a specific puerperal fever. This question may conveniently be discussed on the basis stated by Sir Spencer Wells in the memorable discussion held at the Obstetrical Society in 1876. 'Is there any form of continued fever, communicated by contagion or infection, and occurring in connection with childbirth, which is distinctly caused by a special morbid poison, and as definite in its progress, and the local lesions associated with it, as typhus or typhoid, scarlet fever, measles, or small-pox?'

A correlated question put is: 'Excluding the cases of zymotics attacking puerperæ, may not all the remaining cases be referred to some form of surgical fever, or to erysipelas, caused by or associated with changes in the uterus and neighbouring parts following the process of childbirth?' The answer postulated in this question would express the prevalent or favourite doctrine of the day.

Several of the most distinguished authorities of the last century believed that 'puerperal fever was an essential disease.'

Hulme (1772) says that: 'Puerperal fever is a disease sui generis, as simple and regular in its appearance, for the most part, as any distemper incident to the human body. The pathognomonic marks are: acute pain and great soreness over the lower part of the abdomen, attended with fever, and commonly a pain in the forehead, happening soon after labour. These signs are sufficient to distinguish it from all other diseases.'

Joseph Clarke (1790) is hardly less clear: 'By puerperal fever I mean a disease which generally attacks women on the second or third day after delivery. Its ordinary symptoms are: a cold shivering fit; acute pain in some part of the cavity of the abdomen, and great tenderness when pressed

externally; a rapid pulse; and these soon succeeded by considerable distension of the abdominal cavity.'

Armstrong, a physician of mark in his day, describing, in 1795, an epidemic which prevailed in Aberdeen in 1789-92, said: 'It seemed in every respect to answer the description of the puerperal or child-bed fever, on which many authors have written, particularly Drs. Hulme, Denman, and Leake. There is scarce any disease more regular in its time and manner of attack, or more uniform in its appearance and symptoms.'

The uniformity of the disease is attested by Mitchell, who analysed the histories of all the epidemics he collected, extending over a century, and prevailing in various countries. Peritonitis was the almost universal characteristic; in some it was metritis, or uterine phlebitis; in others, metroperitonitis.

The most conspicuous contemporary representative of this theory is Fordyce Barker. He and others rely upon the fact that fever begins before labour as evidence that it is an essential fever. He says that, in 1873, puerperal fever prevailed in the best class of society in New York, whilst in the poorer districts and hospitals the mortality was less than usual. But this evidence is ambiguous. We have seen numerous examples of fever in private practice taken before labour, assuming more or less epidemic characters. In some instances we traced series of cases of this kind following in the wake of the same practitioner or nurse, whilst women in the same localities enjoyed perfect immunity. One example was very striking. An excellent midwife of the Royal Maternity Charity had a series of more than thirty cases of fever among her charity patients and in her private practice.

The case thus stated will be further illustrated in the next section.

General Idea of; Definition; General Propositions.

The term 'fever' implies toxæmia, or at least some departure from the normal constitution of the blood. The word 'puerperal' of course expresses the process of childbed or 'puerpery.' If we bring these words together, as in 'Puerperal Fever,' we need not imply more than fever in a puerpera. This general expression, vague as it is, and embracing many conditions varying in kind and degree, is the most convenient and

the least compromising that can be formulated. In this sense 'Puerperal Fever' commits us to no theory or creed. It leaves us free to pursue the task of analysis by the light of physiological, pathological, and clinical observation. In this way we may hope to simplify a subject embroiled in conflicting theories, more or less arbitrary and exclusive; and to evolve out of confusion some clear and definite principles which shall serve for scientific classification and therapeutical indications.

A fundamental fallacy in the pursuit of the solution of the problem of puerperal fever has been the search for one hypothesis, one solution. But the laws of biology are not so simple. We must be prepared to accept many facts, not hastily to reject any. We must study all authenticated facts in their individual significance, and in their aggregate relations.

Beginning with the general condition, 'Fever in a Puerpera,' we shall then seek to analyse by differentiation the various states which come under this common denomination; and thus we shall the better appreciate the underlying conditions, the special puerperal phenomena, which justify us in binding them all together into one group.

This is a strictly clinical method of inquiry. Coming to the bedside of a puerpera with fever we at first recognise only the common signs of fever. Then comes the question as to the nature of the fever. The solution of this will often depend upon a knowledge of its etiology, and this in turn will often only be made out by investigation into the history of the case; and not seldom, history failing or leading astray, we are compelled to wait for the development of the symptoms, and for collateral information, which may not come until the illness is ended by death or recovery.

Reverting, for our immediate purpose, to the question: Is there a puerperal fever that has its own characters, its own laws, like scarlatina and its congeners? In one sense the answer must be in the affirmative; in the sense postulated it must be in the negative.

Let us get rid of this apparent ambiguity. Can the puerpera generate a specific poison that will produce a true fever in herself, capable of being propagated to others? This may be doubted. But certainly there arise in every puerpera processes which are peculiar to her state, and which, if disturbed from their orderly course, may lead to fever. Thus, in the comparative histories we have given of the 'Process of Gestation' (see Vol. I.), and of the 'Puerperal Process' (Chapter II., Vol. II.), we see that the sudden revolution wrought on the termination of gestation is marked by local and constitutional changes of the most striking kind. The local changes are, in the first place, traumatic, the immediate result of the violent process of labour; in the second place, the disintegration of tissues in the uterus and correlated organs; in the third place, the altered condition of the blood, a compound of the blood of gestation, into which is thrown the disintegrated stuff of involution, a kind of sepsis which is ready at any moment to evoke inflammatory or febrile action, if its elimination be impeded. In this sense, then, we have a fever sui generis, a puerperal fever. This Robert Barnes long ago called Excretory puerperal fever, to signify fever from impeded excretion. In the same place he styled this disorder 'Autogenetic,' to signify that it arises in the patient's own system, in contradistinction from those fevers which were due to infection from without, and which he called 'Heterogenetic.' These terms have become classic. But their full significance does not seem to be even yet appreciated.

The excretory autogenetic fever is the simplest form of puerperal fever. Upon this form may be grafted: 1. The products of inflammatory action in the tissues of the parturient canal; 2. The products of decomposition or septic stuff on the surface of the parturient canal, absorbed from this surface, and especially from the wounds of the placental site, of the cervix

uteri, and perinæum.

This idea of the radical distinction between gestation and puerpery has been seized by Pajot, who says, 'Nothing in the physiology and pathology of gestation resembles the physiology and pathology of puerpery. During gestation, all tends to hypertrophy; after labour, atrophy is the predominating symptom. The nosological line of demarcation is equally striking.'

We assume, then, that there are certain general underlying conditions which modify all the febrile states to which the puerpera is liable. The following propositions may be stated:—

1. Blood-poisoning in puerpery is:

^{1 &#}x27;Lectures on Puerperal Fever,' Lancet, 1865.

A. Autogenetic, arising from processes inherent to the subject; or, B. Heterogenetic, the result of infection from without.

2. The diseases of puerpery are diseases of low vascular tension, thus diametrically differing from the diseases of the

gravida, which are diseases of high vascular tension.

3. So long as excretion of waste-stuff keeps pace with its disintegration and absorption, the condition is physiological. This depends upon healthy organs, freedom from morbid diathesis, and from intercurrent disturbing influences.

4. When the physiological equilibrium between absorption and excretion is disturbed, waste-stuff accumulates in the

blood: there is toxemia, and toxemia entails fever.

Upon these general laws we may base the following summary of puerperal toxemia. The particular poisons may defy chemical and microscopical analysis. But we are justified in describing two forms: 1. There is accumulation of lactic acid in the blood, the result of excessive muscular energy during labour. The researches of Helmholtz, Brown-Séquard, and Ludwig prove that decided changes take place in the muscles themselves under great exertion. Urea, carbonic acid, and water are discharged in consequence. Dubois-Reymond showed that the muscular juice, which, so long as the muscles are quiescent, possesses a neutral or faintly alkaline reaction, becomes after violent exertion decidedly acid. Lactic acid is thus formed and gets into the blood.

The nervous system also suffers. Bence Jones showed that abundance of phosphates are discharged after great mental exertion. Gamgee ('Edinburgh Veterinary Review,' 1862), in an article on 'Unwholesome Meat and Milk,' says that cadaveric venom and animal poisons of undetermined nature may be developed spontaneously in health or disease. He is inclined to regard as the same deleterious principle, developed in an infuriated and over-driven ox, a passionate woman, the cadaveric venom of the human subject, or that of human beings or animals suffering many hours in labour, or from parturient fever.

The peculiar alteration of the blood, induced by severe nervous and muscular exertion, is further proved by the loss of muscular irritability. This is noted in over-driven cattle, animals hunted to death, soldiers killed in battle after a long

fight. In these cases post-mortem rigidity comes quickly, is of short duration, and putrefaction soon begins.

A woman who has undergone a severe labour presents similar phenomena. Thus we find in protracted labour a cause of autogenetic purperal fever.

This blood-empoisonment is, perhaps, the earliest and the simplest form of purperal fever; but it rarely exists alone. It is soon complicated with—

2. The accumulation of the waste-stuff attending the involution of the uterine and other tissues brought into existence for the purposes of gestation and labour, and which, these processes being accomplished, have to be disintegrated, absorbed into the blood, and discharged by the excreting organs.

Hence we find a distinct source of empoisonment added to that which proceeds from excessive muscular and nervous action. The case is now complicated. Still the toxemia is autogenetic. These two empoisonments are forms of endosepsis.

If the labour have not been severe or protracted, and nothing have occurred to check excretion, this involution-stuff is got rid of as fast as it enters the blood, and there is normal puerpery; no fever. But where the contrary conditions occur, there is a twofold toxemia, and fever results. This twofold poison, and the attendant conditions, will underlie and modify all the diseases of puerpery.

- 3. Then there is a third form of self-empoisonment by absorption of foul stuff, the result of necrosis or decomposition of the tissues of the mucous surface of the genital canal. This is *autosepsis*. Allied to this is the absorption of putrid fluid or gases, the product of decomposing clot or placenta in the uterus.
- 4. Then there is a fourth source of empoisonment, as by infection or inoculation of some foreign poison. This is exosepsis, heterogenetic.

Thus we may understand that there may be a *simple* endosepsis, that autosepsis is grafted upon endosepsis, and exosepsis is a compound of all three.

Thus we arrive at the demonstration of the fallacy so often uttered that scarlatina in a puerpera is scarlatina and nothing

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more. It is something more. It is the foreign zymosis grafted upon the puerperal condition, and modified by it. If the foreign zymosis do not find at the moment of its entry an existing autogenetic fever, this is instantly and necessarily produced. For the new poison at once disturbs the process of excretion.

We may here repeat a formula stated by Robert Barnes many years ago, and now generally recognised, which we believe to be of clinical, as well as of pathological, value: Endosepsis produces a fever possessing little or no infective property; autosepsis and exosepsis are highly infective.

In the natural order we first study the history of autosepsis. The factors of autosepsis breaking out into fever are: Predisposing conditions continued from gestation—as, 1. Hyperinosis. 2. Hydræmia. In addition to the above normal conditions of the blood continued from gestation, there are certain abnormal conditions, as urinæmia and albuminuria, cholæmia. 3. Lowered vascular tension. 4. Lower nervous energy, brought about by shock and exhaustion of labour. 5. The traumatic injuries of labour. 6. The degradation of the blood by the products of excessive muscular and nervous work, and by the rapid absorption of ædematous serum from the perimetric connective tissue and elsewhere. Then we find another group of conditions that disturb the orderly course of puerpery: 7. Those that retard secretion and excretion, as chills; malarious influences; errors of diet, amongst which insufficient diet is one; bad hygienic surroundings, as too high or too low remperature and bad ventilation; emotions. Then there is a group, 8. of conditions that supply a direct poison to the system, as foul stuff from retention of placenta, clots, or lochia in the uterus; the absorption of the cadaveric poison from carrying a dead child; the poison resulting from necrosis of tissue from long pressure under protracted labour or instruments. 9. Another group of causes will be found in the stases and congestions caused by pregnancy (C. Braun). 10. The strumous diathesis, and other constitutional dyscrasiæ, especially predispose. 11. Then there often occurs a most owerful predisposing cause in hæmorrhage. If this exceed in marked degree the physiological amount, the rapidity and activity of the process of absorption are enormously increased;

and any noxious matter in the tissues, or in the parturient eanal, is more sure to be taken in. At the same time, the secreting and excreting energy being lowered, the absorbed noxious matters are almost sure to accumulate.

Sometimes associated with hæmorrhage, but sometimes resulting from other causes, is a relaxed state of the uterus. This has been insisted upon as a condition of primary importance by some French authors, and in England by Graily Hewitt. It is undoubtedly in some cases a powerful predisposing factor. But it is sometimes secondary upon the fever. The patient may at first have had a well-contracted uterus; then comes the fever, and following upon it is the relaxation of the uterus. Having premised this general description of the excretory puerperal fever theory, we may pursue the examination of the other theories that have been enunciated.

The theory of putrid absorption.—The favourite theory of the last century was that the disease arises from absorption of putrid matter. Kirkland thus expresses it:—'There are other causes besides inflammation which bring on a puerperal fever, for it sometimes happens that eoagulated blood lodges in the uterus after delivery, and, putrefying from access of air, forms a most active poison—is, in fact, absorbed—and brings on a putrid fever.' The same theory is expressed in nearly identical terms by White.

Clinical observation abundantly proves that a large proportion of autogenetic cases arise in this way.

Robert Ferguson injected putrilage into the veins of animals; phlebitis and typhoid symptoms followed. Semmelweiss performed similar experiments on puerperal rabbits. Denman and Van Swieten preceded Semmelweiss (1847) in advocating the doctrine now generally received, that every case of puerperal fever is to be looked upon as a resorption fever, excited by the reception of a decomposed animal matter, whether this be introduced from without or developed within the subject (Selbstinfection). This doctrine, says Spiegelberg, comprises in general all there is to be said about the origin of puerperal fever. And since, he says, the reception of the infecting stuff can only come from the wounded tegument, from a wound, so puerperal fever belongs to the order of ordinary wound-fevers, inasmuch as this idea embraces all the

phenomena which arise in the entire organism as consequences of the local wound-inflammation, and the local absorption of

septic stuff.

The consideration of the traumatic theory cannot well be taken up apart from the septicemic theory. Points of distinction may, indeed, be made out; but to some extent traumatism and septicemia are conjoint factors. The conditions under which septicemia may be held to work independently of traumatism will be pointed out. Traumatism alone cannot induce puerperal fever. Traumatism is universal, and fever is exceptional.

It appears to us that the term 'traumatic fever' is entirely arbitrary. If it be assumed that the wounds made in childbirth never heal without undergoing an inflammatory process which sets up fever, the negative evidence of the vast majority of puerperæ, in this country at least, contradicts this assumption. These wounds, under good hygienic and individual conditions, heal without fever. In the German lying-in hospitals—the birth-place, we believe, of the traumatic theory -febrile irritation, more or less closely verging on declared fever, is no doubt common during the healing stage of the labour-wounds. But this febrile movement is the expression of infection. The term 'traumatic fever,' then, may properly be discarded as misleading. The wounds are inevitable, and, if kept clean and the subject be healthy, are harmless. All sound prophylaxis is based upon this law. That hospital stands convicted of mal-administration in which poison from without is allowed to enter by physiological wounds. Appeal to the hypothesis of traumatic fever is vain.

The appearance of crysipelas or diphtheritic membrane on the traumatic surfaces is no proof that the morbid process began on those surfaces. The rash of scarlatina, rubeola, is especially apt to break out with most intensity at the seat of injury. Thus, Paget says he cut a boy for stone; three days after he became very ill, but soon a viscid red eruption appeared at and about the wound. This was measles, earliest and most intense at the seat of injury, just as erysipelas might have been. He saw similar events with scarlet fever, and William Budd recorded a case of small-pox which appeared most intensely over a bruise on the nates. Thus, says Paget, 'the local determination of

erysipelas and of other allied diseases is no proof at all of their local origin or local nature. The same local manifestations happen in the truest eruptive fevers.'

The septicemic theory is that which holds, at the present time, the greatest sway. It is not inconsistent with the theory of infection by microbes; nor does it depend upon that theory. Its clearest exponents are Schroeder and Spiegelberg. Schroeder postulates first a wound. This is found in every newly delivered woman. Through some wound in the parturient tract a poison is introduced. If there is no wound, there is no infection. If the wounds remain in their simple state, granulating, there is no evil, or at most the accidents are purely local, simply inflammatory. But if infection touch these wounds, then there is propagation of the inflammation, empoisonment of the woman, and the series of phenomena called puerperal fever.

Spiegelberg sets out a similar hypothesis. He says: 'Every wounded tissue is, at the seat of the injury, necrotic tissue. Around this there arises inflammatory reaction, which spreads to surrounding tissues, but which is less intense in proportion to the distance from the centre. This inflammation favours the resorption of the necrosed particles. Even when a violent crushing has taken place, the crushed tissue does not die off, but is absorbed through the reactive surrounding inflammation. But if germs of putrefaction come into the wound, then through their action the wounded tissue dies off, and these germs now excite wound-suppuration and wound-fever.'

It is quite different when the so-called 'septic' poison is brought to a fresh wound, infects it, or when such poison first forms upon the suppurating surface. Then this is of a nature quite distinct from the simple putrefactive matter, and it operates differently. It is not destroyed by the living tissues, as the putrefactive germs commonly arc, but it spreads from the place of reception throughout the body, and there chiefly multiplies. The postulate that the poison can only enter through a wound is disproved by facts. Thus the septicæmic theory as stated by Schroeder falls to the ground.

In a recent discussion in New York the septicæmic theory was almost universally accepted. Thus, Thomas, Lusk, and Mundé affirm that puerperal fever is puerperal septicæmia.

The most remarkable dissentient is Fordyce Barker, who still adheres to the opinion expressed in his work that puerperal fever originates from epidemic causes, from contagion and infection. He believes in septicæmia from nosocomial malaria and direct inoculation.

Hutchinson submits that the term 'septicæmia' ought to be applied to the result of poisoning of blood induced by the inflammation of the patient's own tissues. We very often get symptoms of septicemia in cases in which there has been no possibility of their being produced by morbid poison from without. He admits the influence of morbid matter as an irritant in setting up inflammation; but he believes that the stage of gangrenous inflammation of the part is one which is essential to septicæmia. Local injury is an accident which may start the septicæmia. But for this to arise presupposes a peculiar state of the blood. The prick of a needle, the sting of a bee, the most trivial operation, may, in some states of the constitution, prove fatal. Healthy persons may resist a poison even which would do fatal mischief in certain unhealthy states. Thus, vaccination in healthy subjects may set up a perfectly regular zymosis; whilst in certain unhealthy subjects erysipelas, or diffuse cellulitis, may follow. And we may use the analogy of vaccination in further illustration of the peculiarities of gestation and puerpery. Just as gestation and puerpery may evoke any latent morbid diathesis, so that these conditions become tests of the soundness of the subject, so may vaccination evoke latent morbid proclivity, as syphilis. When this happens, the lymph used for inoculation is too readily accused of carrying the syphilitic poison with it. What do we know of the interreactions of two or more poisons circulating together? Very little. But the history of fevers in childbed certainly shows that one or the other poison is modified, and it is quite possible that a new one may be produced.

An interesting illustration of this view is given by Hutchinson in a valuable memoir, 'Causes of Death of Ewes after Parturition' ('Obst. Trans.,' 1877). He obscrived that ewes, whilst giving milk, became liable to a sort of idiopathic tetanus, if fed upon 'cotton-cake.' The same food given to lambs, hoggets, and undelivered ewes produced no ill effects. It seems, then, a clear proof that a noxious irritant was produced by a substance

taken into puerperal blood, which in non-puerperal blood was harmless.

In this connection we may cite, as examples of the part played by traumatism and septicemia, cases of adherent placenta, in which more than usual injury was inflicted by the forcible detachment, perhaps incomplete, of this organ. Hegar, Hüter, and others have satisfactorily proved this source of danger. In some cases a piece of placenta remains attached, forming the 'placental-polypus.' In such cases septicæmia is easily set up.

Stadfeldt relates a case which suggests another view. A 1-para was delivered in hospital, after fifty-two hours' labour, of a dead child. Signs of metritis were observed during labour. She died on the third day. Autopsy revealed peritonitis, metrophlebitis, endometritis; the uterus imperfectly contracted, the inner surface covered with an abundant, partly puriform, partly chocolate-coloured mucous layer capable of being scraped off. In the left superior angle of the uterus was attached a bit of placenta, the size of an egg. Stadfeldt says, it cannot be denied that the same process in the uterus which was the cause of the adhesion of the placenta gave rise to the unusually early and violent occurrence of the puerperal fever. The fever was caught in the hospital before labour.

Analogous to these cases of placental-retention are those in which fibroid tumours, imbedded in the uterine wall or projecting into the cavity, have complicated labour. In some of these cases, especially if the tumour have been attached to the fundus of the uterus, no trouble may result. In a second class of cases the tumour undergoes crushing, bruising, even tearing, during labour; it is then apt to fall into necrosis, and a bad form of septicæmia is set up. In a third class, the tumour may have undergone no injury, but, being compressed by the contracting uterus after labour, its supply of blood is suddenly diminished, it falls into necrosis, and septicæmia results. We have seen examples of all these conditions. Chiari, Braun, and Spaeth relate a case ending fatally on the second day of endometritis sphacelosa following labour with fibroid tumour in the uterus, secale having been given. This is a case in which secale ought not to be given.

¹ Pathologie und Therapie der Placentaretention, 1862.

² Die Mutterküchenreste. Monatssehr. f. Geburtsk. 1857.

The identity of puerperal fever and so-called surgical fever is held by many. The question was formally put by Spencer Wells as the basis of discussion by the Obstetrical Society of London. His propositions are stated at p. 411. It falls within the discussion of traumatism and septicemia.

That there are many points of analogy is undoubted; but there are also points of difference which forbid us to accept the doctrine of identity. The subject of an amputation, and a woman after labour, both present wounds. Both may be considered as susceptible to invasion by poisons. In both the poison may effect a lodgment on the wounds. But it is easy to carry the comparison too far. Amputation is presumably performed on account of disease. The condition of the patient is pathological to start with. There is no special provision in the system made for the express purpose of healing the wound. The wounds in the puerpera are physiological. There is a distinct provision ad hoc for restoration to the ordinary state. It is in this provision, marked by extraordinary activity of absorption and excretion, that lies the peculiarity of the puerperal state. This condition has no parallel in the ordinary surgical patient.

And if we accept, for the occasion, the comparison between the surgical and the puerperal patients, the case is far from being so much simplified as is assumed. If we are asked, What is puerperal fever? may it not be asked in return, What is surgical fever? Is surgical fever one uniform, definite, pathological entity? Would it not be a truer statement to say that, just as puerperal fever can only be accepted as a general term to signify fever in a puerpera, so is surgical fever a general term to signify fever in a surgical patient? In neither is the fever one constant thing. There are varieties of surgical fevers as there are varieties of puerperal fevers. If it be contended that by surgical fever is meant septicæmia and nothing else, this is simply begging the question; we must still ask, What is septicæmia? And again, if surgeons are prepared to give a precise definition of septicæmia in surgical patients, are they also prepared to show that a septicæmia of the same character is produced in lying-in women? Septicæmia is a compound term. There is the sepsis, the poison; there is the blood which receives the poison. Now, if it be possible to show that the sepsis in the two subjects is identical, it would still be necessary to show

identity or near similarity in the recipient blood. The first term of the proposition is certainly not proved; the second is certainly not true. This theory, then, like that of the microbists, is too absolute and exclusive. It may account for a large number, perhaps the greater number, of cases in lying-in hospitals; but it does not account for cases beginning before there is a wound, nor for the propagation to non-puerperal women.

The theory of Empoisonment by the agency of Microscopic Organisms: Bacteria; Micrococci; Microbes.

This theory, gradually developing since the researches of Mayrhofer, especially in 1865, has now acquired consistency, if not as an all-sufficient explanation of the production of puerperal fever, at least as an important factor. Mayrhofer discovered in the lochia of sick puerperal women moving vibriones, which he declared were the cause of the intoxication. Recklinghausen and Waldeyer showed the presence of these vibriones, not alone in the lochia, but on the surface of puerperal wounds, in the nterine lymphatics, in the infiltrations of the connective tissue, in the exudations of the serous cavities; and demonstrated that the bodies with fine nuclei described by Virchow and Hohl were moniliform bacteria. Several observers pursued this course of investigation. But it is to Pasteur that we owe the clearest and most definite conclusions.

We borrow from Charpentier, who has given the best review of the subject, the following summary of Pasteur's doctrine by Raymond: When the lochia of a puerpera in good condition are examined, few or no microscopic organisms are found. But if the lochia of a woman threatened with puerperal disorder are examined, one is struck by the abundance of the organisms; and, if death happens, the same organisms which had been observed in the lochia are found in the pus of the peritoneum, in the uterine lymphatics, in the pleuritic effusions, in metastatic abscesses, in the visceral suppurations. Pasteur even succeeded in proving, by his processes of culture, that the blood of affected women, even before death, contained microscopic organisms. Further, Pasteur was able, by the simple examination of the lochia for organisms, to predict an

¹ Traité pratique des Accouchements, 1883.

attack of fever before the most searching clinical observations of the physicians awakened suspicion of evil.'

The particular organism described is the chapelet en grains. But Pasteur says this particular form is not the only one found. Puerperal fever, he says, has no special microbe. There are several forms. The noxious organism is cultivated abundantly in the lochia, in the uterine cavity. The peritoneum, being contiguous, is penetrated by it; there it is cultivated, and produces, by its rapid multiplication, the peritonitis with pus filled with the organisms. If the medium offered by the peritoneal cavity is not favourable to this organism, the disorders are more limited. Instead of intense general peritonitis we shall see pelvi-peritonitis of slower course. But successive invasions from the uterine cavity render it difficult to cure.

'It is thus easy to understand the cases of phlebitis and pelvi-peritonitis. It is the situation of the wound, the connections of the uterus, which increase the danger; and it is this alone which is peculiar to the puerpera, distinguishing her as a specially-wounded subject. Let the microbe come, having before it so many open doors, be it an infective organism of the nature of the septic vibrio to which Pasteur attributes the special septicæmia which he has studied in animals, the disease will take the infective and rapid form, and we shall witness those cataclysmic deaths which have so often desolated lying-in hospitals. The blood then presents the characters observed in typhoid diseases.

'When we consider the variety of forms presented by puerperal fever, it is difficult to admit that it is caused by one infecting agent, one microscopic organism.'

That micrococci exist in the living body and play an important part in the morbid process is made evident from many observations, and especially from the following case recorded by Lomer. A 9-para, on account of placenta prævia, was delivered by turning and extraction. Twenty-four hours later she had a chill, and peritonitis set in; then followed diffuse phlegmon of the right labio-crural region, phlegmon of the lower part of the left leg, with varicosities in a state of superficial gangrene, and diffuse phlegmonous swelling of the right hand and lower part of the right arm, also exquisite

euphoria. Death on the fifth day. Blood drawn during life was crowded with chain-like micrococci. One hour after death, a necrotic endometrium with purulent peritonitis was found. Micrococci were found in the pus and in the liver and kidneys. Micrococci have also been found in pemphigus vesicles.

Coze and Feltz made hypodermic injections of blood taken from puerperal-fever patients in rabbits. Most of the animals died of diarrhœa and convulsions. Eberth inoculated the corneæ of rabbits with croupous exudations from women who had died of puerperal fever, and found that the diphtheritic process was continued upon the cornea, and that the matter contained micrococci.

Still the question returns: How are these infective microbes introduced? The answer, that they attack the wounds caused in labour, does not cover the whole case. For some women are attacked before labour; and the great majority of women, notwithstanding those wounds, escape puerperal fever. And how, it has been pertinently asked, do the organisms find entrance in those most terrible cases of all in which death follows in a few hours? The uterus, fully contracted, has left no gaping mouth; the lochia have not been fetid; there has been no phlebitis or lymphangitis or phlegmasia of any kind. What open road have the microbes found to invade, not alone the puerpera and the child she bears, but also the nurses and the midwives who are living in the midst of lying-in women? But these last are seized notwithstanding, and present the peritonitis so characteristic of puerperal infection.

The conclusions of Pasteur are not uncontested. Thus, Artwing, in a recent communication to the Société des Sciences Médicales of Lyons, whilst verifying the association of microbes with puerperal fever, maintains that the different forms of puerperal septicæmia are all due to the action of one living poison; that there is only one micro-organism concerned; and that this has not been proved to be special to the puerperal state. Lomer¹ states the following conclusions: 'In puerperal fever in erysipelas, in scarlet fever, in diphtheria, and in the secretion of wounds, chain-like micrococci are found which have as yet not been proved to possess individual differences. But it may

^{&#}x27;Our Present Knowledge of the Relations between Micro-organisms and Puerperal Fever.' Amer. Journ. of Obstetrics, July 1884.

hereafter be shown that there are different kinds of chain-like micrococci, that each kind has its distinct and specific action.

When in any case of puerperal fever the presence of these micrococci has been detected in the exudation, they have also been found in the deeper organs.

Other micro-organisms may be present, but their presence in the dead body does not always prove that they existed in the living body; they are often the result of post-mortem decomposition.

It is as yet impossible to classify puerperal fever as regards course and prognosis according to the varieties of the microorganisms found (Doléris), or according to their mode of invasion (Fraenkel).

We will now sketch the second form of puerperal fever, taking first the more typical autogenetic fevers.

- 1. First of these is the simple excretory puerperal fever. This has been sufficiently described. (See antea, p. 414.)
- 2. Pelvic Cellulitis or Parametritis; Pelvic Peritonitis or Perimetritis; Metro-perimetritis; Inflammation of the Broad Ligaments. Salpingitis. Colpitis.

Sometimes toxemia reveals itself in general systemic disturbance; sometimes inflammatory complications constitute the most conspicuous feature. It may be taken as a general fact that, where acute inflammations occur, the general bloodpoisoning is less severe, or that the condition of the blood is sounder, more able to resist the noxious action of the invading poison. Thus, we may, in most cases, look upon pelvic cellulitis and pelvic perimetritis as evidence of a reserve of power in the subject, which may carry her through the trial. The disorder is localised, whereas in extreme cases the entire system is overpowered.

Inflammation is rarely limited to one tissue. Hence the danger of error from adopting in their strict sense the terms 'perimetritis' and 'parametritis,' or equivalent terms. Commonly, inflammation of the connective tissue of the broad ligaments is complicated with pelvic peritonitis. Is there such a state as pure inflammation of the pelvic tissues after labour? We doubt it, believing that a toxemic element is always concerned.

Not only may the connective tissue and peritoneum be the seat of inflammation, but the substance of the uterus itself may be inflamed = metritis; the vessels, especially the veins = phlegmasia; and the lymphatics = lymphangitis.

It is a general law that organs that have been recently engaged in active or extreme physiological work arc especially susceptible to inflammation. It is interesting to inquire which tissue is the first to be attacked. Postulating, as we do with some confidence, that the immediate cause of inflammation is an irritating matter carried in the blood, we shall naturally conclude that the inner coats of the vessels, the veins and lymphatics, will be the first affected. The venules and lymphatics are the direct recipients of foul matter from the inner surface of the uterus or other traumatic area. Accordingly we find the vessels almost invariably affected. By contiguity, the morbid process extends to the substance of the uterus: myometritis; thence to the vessels and connective tissue of the broad ligaments, and thence to the investing peritoncum. The greatest virulence of the inflammation is often spent upon the cellular tissuc. The plastic or adhesive character of the inflammation of this tissue serves to limit or to localise it here. There is a marked analogy in this condition to that of thrombosis, which we shall presently describe. It is probable that in many cases, at least of so-called pelvic inflammation, the initiative condition is thrombosis. The order of events is as follows:-1. There is irritating matter on the placental site or other part of the uterine surface. 2. This matter is absorbed into the venules and lymphatics. 3. Coming in contact in these vessels with hyperinotic blood, in a state approaching stasis, the fibrin is precipitated, forming thrombi. 4. The irritating matter retarded in the vessels sets up inflammation in the walls of the vessels, whence it extends to the connective tissue and peritoneum, as already stated.

Thus we see that pelvic inflammation is a conservative process, limiting or controlling the spread of poisonous matter into the general circulation.

We may analyse the cases of pelvic-peritonitis into three principal varieties, always bearing in mind that there is no rigorous line of demarcation. 1. There are cases in which inflammation is not obviously complicated. This will tell more

especially upon the peritoneum. After extreme physiological activity of the uterus, its investing membrane—like the pleura—may, under a sudden impression of cold or violence, become inflamed. The influence of cold is well illustrated in some cases, where the abdomen has been kept swamped with cold water or ice after labour, or where ice has been applied inside the uterus. Violence in the shape of rough 'kneading' to expel the placenta and to arrest hæmorrhage is also very apt to cause inflammation. We have known it to be caused by coitus forced upon the woman within a few days of labour.

Symptoms and course. It rarely manifests itself before the third day; and it is interesting to note that the process of involution, disintegration, and absorption is only beginning about this time. This fact has a wide application in the study of puerperal disease. On the other hand, the susceptibility continues for an indefinite time. Inflammation may break out when an adequate exciting cause is applied. Thus, a young lady of delicate organisation suckled imperfectly for seven weeks; whilst menstruating she underwent great fatigue, and came home with intense abdominal pain and fever. This is not an uncommon history. It points to the analogy between labour and menstruation. In such cases the inflammation is primarily peritonitic.

But not even in all these essentially inflammatory cases is the inflammation expended upon the peritoneum. There is a group of cases in which traumatism appears to be an essential factor, in which the chief, or at least the primary, seat appears to be the perimetric connective tissue. During the passage of the child's head through the parturient canal there is commonly laceration of the cervix uteri, bruising, even crushing, of the mucous membrane, attended by a dragging or glacier-like movement of the structures in most immediate contact with the head upon the subjacent tissues. The cellular tissue around the cervix is especially contused, stretched; vessels in it are torn; hence effusion of serum and ecchymosis. All this we have frequently verified by inspection. Everything is prepared for inflammation. The local injury, the effusion, the hyperinotic blood charged with effete matter, are there; an exciting cause is alone wanting. A chill is sufficient. The chief seat of inflammation is the wounded cellular tissue. In this tissue it may run its course,

ending in resolution or in absccss, the peritoneum being perhaps only slightly implicated.

In another order of cases, characterised by the predominance of a septic factor, the inflammation of the pelvic tissues is universal. The uterus itself, its blood-vessels and lymphatics, the connective tissues around them and in the broad ligaments and the peritoneum, are all involved in inflammation of a low type. The inflamed peritoneum, throwing out unhealthy lymph, which rapidly breaks down into pus, sets up the like inflammation in every part of the abdominal peritoneum with which it comes in contact. Septicæmia attends, constituting a form of autogenetic puerperal fever. Endosepsis and autosepsis are combined.

A still more complex order of cases are those in which poisonous matter is inoculated from without. The poison of some zymotic, erysipelas, or the septic matter from another puerperal woman, pus or ichor from a wound, or the cadaveric poison is absorbed by the traumatic surfaces left by labour. This constitutes a form of heterogenetic puerperal fever. In this order of cases the disease commonly breaks out carly—on the second or third day. There is general blood-infection; fever of a low type—'typhoid' it is sometimes called—is apt to carry off the patient in a few days, perhaps before any marked local inflammation can be produced.

We may still recognise a mixed order of cases, in which there is a septic factor, controlled by a comparatively healthy state of blood. The inflammation begins in the uterine sinuses and lymphatics. Under the combined influence of traumatism, of blood impaired by the tissue-changes of puerpery, and sometimes of decomposing debris of placenta, membranes and bloodclots in the uterine cavity, foul matter gets into the uterine sinuses and lymphatics, and, not arrested there, from want of contractile energy in the uterine fibre, or because being as yet too abundant for the blood it meets in its course to segregate by coagulation, it invades the vessels in the broad ligaments, where further progress is stayed by the formation of clots. This thrombotic process is generally attended by inflammation of the peri-vascular tissues and of the broad ligaments. If the lymphatics be concerned as well as the veins, then the phenomena of phlegmasia dolens are developed. In this order of

cases the symptoms declare themselves later than in the preceding order. It may take a week, or even a fortnight, before the signs of thrombosis become clear.

That the broad ligaments are chiefly involved in the majority of these cases seems proved by the seat of the tumefaction being in the sides of the pelvis; by the inflammation being in many cases unilateral, the side affected being usually that in which the placenta was attached, or frequently the left side, being that on which the cervix uteri was fissured by the occiput in labour. This latter source of pelvic cellulitis has been much insisted upon by Whitehead and Emmet.

Trousseau may be cited as insisting upon the frequent complication of phlebitis with inflammation of the broad ligaments.

A very similar description will apply to the perimetric inflammations of abortion. It applies often very closely to inflammation of the broad ligaments, leading to phlegmasia dolens, beginning in cancer of the cervix uteri.

The fallopian tubes may become inflamed, perhaps primarily, but certainly by spreading from the vagina and uterus. This is especially seen in the peritonitis meretricum, in which the starting-point is gonorrheal infection. In some cases of this origin, the tubes become distended by pus, and this is poured into the peritoneum either by rupture of the tube or overflow by the fimbriated extremity. The ovaries, first catching the foul irritant, are sure to be involved. In like manner, a simple puerperal endometritis may spread to the tubes; or the tubes may first become inflamed from foul matter being generated in them or taken up from the uterus.

It is remarkable that gonorrheal peritonitis may break out after childbirth. Mr. Giles ¹ relates three cases of this kind. Dr. Emil Noeggerath ² discusses this subject in an elaborate memoir. He submitted that gonorrhea, apparently cured, may linger in certain portions of the generative organs for life, constituting 'latent gonorrhea'; that in this form it may infect a healthy person with acute gonorrhea; and that in the female it may pass from the latent into the apparent form, giving rise to acute, chronic, or recurrent perimetritis or

¹ Brit. Med. Journ. 1871.

² Bonn, 1872, and Amer. Gynec. Trans. 1876.

ovaritis. Dr. Macdonald ¹ followed up the subject. He discusses Noeggerath's opinions, and gives some interesting cases of his own. He says that in cases of gonorrheal puerperal endometritis, 'the discharge during the acute attack is very characteristic. It is not like the ordinary lochia at all. It is thin, sero-purulent, and exceedingly profuse at first, and then becomes less in amount, yellow in colour, tough in consistency, and excessively offensive to the smell.'

The suspicion of a case of this kind would be an urgent motive for practising intra-uterine injections of iodine.

Salpingitis puerperalis. A condition not seldom observed in connection with puerperal fever is inflammation and suppuration of a Fallopian tube. This condition has been described by Ed. Martin (1851), F. Howitz (1858), Förster (1859), Vocke (1860), and since those dates by several authors. R. Barnes published ('Obst. Trans.,' 1862) a case following induced abortion, with historical notes of the subject. It may be a part of the morbid process, as when it is associated with metritis; then there is metro-salpingitis. Or it may constitute the principal feature of the case. The great danger attending it is the rupture of the distended tube, and the sudden escape of the offending contents into the peritoneum. Or there may be overflow from the fimbriated end of the tube. The late Professor Martin, of Berlin, related several cases.2 He says it does not always begin in the puerperal week, but sometimes during gestation-sometimes, indeed, before the actual pregnancy. He thinks in one case it began in blennorrhæa.

When escape of pus takes place there is sudden acute pain; fever follows, and tympanites, which obscures to some extent the peritonitis. If death does not follow when involution of the uterus has made progress, the enlarged tubes may be felt. It is not probable that a cure is effected, and in the chronic state, danger of bursting or extending peritonitis is always impending.

It appears to us that these are cases in which Lawson Tait's operation—the removal of the diseased tubes—may find legitimate application.

¹ Latent Gonorrhæa with special relation to the Puerperal State, 1873.

² Ueber Mutterröhrenentzündung und Erguss des eitrigen Sekrets derselben in die Bauehhöhle. Monatssch. f. Geburtsh. 1859–1861.

Phlegmasia Dolens, or Thrombosis; Thrombotic Puerperal Fever.

The history of phlegmasia dolens naturally follows upon that of pelvic inflammation. Phlegmasia dolens, like perimeritis, is a variety of puerperal fever. It is a toxemic disorder. It is most commonly autogenetic. The toxemia is localised or limited. The two conditions are closely linked in genesis and nature. They arise in similar conditions; and it may be held that at the moment of invasion it is uncertain what form the disease may assume; accidental conditions, not clearly defined, may determine the evolution into perimetritis, phlegmasia dolens, or general septicæmia.

We have seen that in one form of perimetritis, in which the septic element is marked, but not overwhelming, the quality of the blood is so good that it resists the transit of the septic natter, and isolates it in the pelvic tissues. A similar event also happens in phlegmasia dolens. Both in this respect are conservative processes. The blood, clotting under the precipitating power of the poison, shuts it out from the general circulation. On the other hand, when the system is depressed, he blood poor, and the supply of septic stuff is copious, rirulent, and sustained, the clotting virtue of the blood is overwhelmed and general toxemia takes place. The thrompotic process is inefficient; the imperfect clots break down in uppuration.

The name 'phlegmasia dolens'—an arbitrary compound of pathological hypothesis and of a symptom—would be indequate, even if it were not based on error. That the veins n the broad ligament and the femoral vein are commonly nflamed is true. But this is not the essence of the discase.

It is convenient at the outset to enumerate some of the heories which have been held:—Mauriceau thought phlegnasia dolens was due to suppression of lochia; Puzos and evret thought it due to metastasis of milk; Dr. Hall thought tonsisted in general inflammation of all the tissues of the ffected limb, whence coagulable lymph was thrown out into the ellular tissues; White, of Manchester, a remarkable clinical observer, said it was due to obstruction of the lymphatics; Ferrier attributed it to inflammation of the lymphatics; his view was adopted by Hamilton, Gardien, and others;

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D. D. Davis, recognising the clotting in the veins, advocated the pure phlegmasic theory, contending that the disease consisted in inflammation and obstruction of the principal veins of the extremity; Bouillaud and Robert Lee adopted this theory, and it was generally accepted.

The right path was first struck by Gulliver, who showed the conditions under which blood coagulates in the veins. He especially described the process of change into pus-like fluid which takes place in the interior of the clot, distinguishing it from suppuration. In this he was followed by Virchow. Henry Lee (1852) made 'important experiments showing how difficult it is to cause inflammation of veins by any irritants; that irritants act by causing the blood to coagulate. Gaspard's experiments told the same thing. Henry Lee's proposition, 'that no one has satisfactorily demonstrated the presence of an inflammation limited to the lining membrane of a vein,' is still justified.

We must not, however, forget that thrombosis may be the result of embolism. Thus, J. Y. Simpson relates the case of a woman who died of phlegmasia dolens of the left arm and side of the face some weeks after an exhausting labour. After delivery she had signs of embolism, first in the right brachial artery, and then in both legs; then came on phlegmasia dolens in the left arm. The aortic valves were covered with wart-like excrescences. It was suggested as probable that fibrinous detritus passing from the arteries into the capillaries and veins of the left arm caused phlebitic thrombosis.

The more recent researches of Mackenzie and Tilbury Fox

give precision to the foregoing observations.

Mackenzie (1861) proved by one set of experiments that inflammation produced in veins caused none of the phenomena of phlegmasia dolens; and, by another set, that when phlebitis was caused by vitiating the general mass of the blood, the phenomena of phlegmasia dolens ensued. Tilbury Fox (1862) came nearer to the mark when he showed that obstruction of the main lymphatic channels is alone capable of giving rise to white leg, acting by preventing the removal of lymph from the affected limb. He further illustrated this by pointing out that the character of the swelling is not that of serous stasis produced by blood disease, the enlargement being unequal and

commencing above and extending downwards. He said it was due to sudden absorption of acrimonious fluids.

There is an element of truth in all the above theories. If we interpret the ideas of 'suppression of lochia' and 'metastasis of milk' as implying arrest of secretion and excretion, and therefore the accumulation of noxious stuff in the blood, we recognise a true factor; that there are phlebitis and venous obstruction is certain, although these are secondary or tertiary features; that there is obstruction of the lymphatics, is now

abundantly proved.

This preliminary statement made, we may now pursue the clinical study of the affection; and thus, out of the phenomena observed at the bedside and in the dead-house, we shall endeavour to evolve a consistent theory that shall harmonise with facts, and give us sound principles of treatment, prophyactic and remedial. We may first put and answer the question: Why is thrombosis so pre-eminently venous? The easons are, that venous blood is more impure, and that it is he immediate recipient of the offending precipitating stuff. The blood that has become arterial has at least gone through attempt at purification by traversing the lymphatics, liver, and lungs.

Two forms may be distinguished, the one comparatively imple, the other complicated with general toxemia. The rst is not very dangerous; the second is commonly fatal.

Thrombosis is essentially a disease of puerpery. But we are seen a few cases which apparently arose during gestation. none of these we traced antecedent venectasis, a condition which no doubt favoured thrombosis. Cases are cited on p. 377.

Unical History of Thrombotic Excretory Puerperal Fever.

1. The simple form. The patient may have been going n to all appearance favourably for some days after labour, hen, more or less suddenly, fever, attended or preceded by gors and vomiting, occurs. The temperature rises to 100° F., and even to 103° or 164°; the pulse runs up to 120, not always the onset, but soon reaching this point. Perspirations are ften profuse; the respirations rise to 30 or more, and occaonally syncope occurs, with intermittent pulse and palpitation. Then, following quickly, acute pain is felt in the ham,

in the groin, or in the iliac region of one side; the leg, usually the left, is found by the patient to be stiff, and to be impaired in mobility; soon it is seen to be swollen, the swelling beginning in the thigh or leg and extending downwards. There is usually hyperæsthesia of the surface. The swelling has other points of peculiarity, distinguishing it from the ædema of obstructed veins; it is tense, giving a glistening, shiny, white aspect to the skin—the affection is called by some older authors 'phlegmasia alba dolens.' To the touch the swollen part gives a sense of resistance quite different from the doughy feel of ædema; it does not pit under pressure of the finger, but the impression made is quickly removed.

If the part is pricked with a needle, instead of serum running off as in ædema, a droplet of fluid will start out on the skin, which quickly coagulates. The fluid is charged with coagulable lymph, which the obstructed lymphatics could not carry off. Pain is evoked on pressure in the groin and in the ham; on palpation in the groin and in Scarpa's triangle, the femoral vessels are felt as hard cords, and the attendant lymphatic glands are felt as knots or lumps, the connective tissue around the vessels being the seat of coagulated effusion, which has matted all the structures together. Some tenderness will commonly be revealed by palpation deep in the iliac region, and occasionally the conditions felt in the femoral vessels may be made out in the iliac vessels. Examined internally, we may also frequently realise the complication with perimetritis, the constituents of the broad ligament being the seat of inflammatory effusions. In this we see the relation between the ordinary form of perimetritis and the affection we are now discussing. It is to be noted that the perimetric complication often appears a little later.

In two or three days, for the swelling advances rapidly, the leg becomes completely powerless. This is partly due to pressure upon the nerves by the effusion, and partly to the intra-pelvic complication. The leg is usually abducted and turned out; the patient is prostrate, helpless. From time to time there is observed in some cases a repetition of the symptoms which marked the invasion of the disease: rigor, vomiting, attack of local pain, increase of fever. These symptoms indicate a fresh entry of noxious stuff into the blood. Thus, we

have watched a case in which three distinct febrile attacks took place at intervals of some days, each attack being quickly followed by evidence of fresh thrombosis in superficial veins of the legs.

The fever and more urgent local signs commonly subside in from seven to ten days; the limb remains swollen, but is less tense; it may now 'pit.' There is generally depression for some time longer. Sometimes a measure of relief is attained by the establishment of collateral venous and lymphatic circulation. The swelling gradually subsides; but a degree of paralysis of the limb continues for two or three weeks or more.

This simple form is comparatively free from danger. It is an illness of forty to fifty days' duration. The absorption of the effused lymph and serum and fibrinous deposit takes time. Not seldom, when the leg first seized is mending, the other leg is attacked. Fever ushers in this attack, and the whole history is repeated.

In a remarkable case recorded by Fancourt Barnes, a young lady, after a natural labour, had febrile symptoms on the fourth day; attacks of syncope followed; on the sixteenth day mania set in; loud bronchitic râles appeared; a thick purulent discharge came from the vagina; on the twenty-third day the left leg began to swell, the mania diminished; on the twenty-eighth the right leg began to swell; on the thirtieth the left arm was swollen, and white like the legs. There was also some stiffness in the right arm, but it did not swell. After the left leg began to swell she had several attacks of cyanosis; her respirations rose to 48, and she died forty days after labour. An autopsy could not be obtained; but it is fair to interpret the phenomena as due to general toxemia and multiplied thromboses; the lung affection was evidence of the pulmonary infarction of Virchow, capillary embolism. The case has analogies with the cases of phlegmasia dolens occasionally met with in typhoid fever and in cancer.

Dr. Bastian relates a remarkable case of extensive thrombosis. A 2-para had been confined three months. She got up a fortnight after labour. Three weeks later mastitis and abscess appeared. Soon after this the left ankle swelled. The left leg then showed the common phenomena of phlegmasia

¹ Brit, Med. Journ, 1879.

dolens. The heart sounds were normal, pulse 160, perspirations profuse, no albumen in urinc. The temperature rose, and the right foot swelled. Then the left shoulder and left side of the neck became affected. The swelling then extended down the arm and to the fingers. Next, the right side of the neck and right arm swelled; then the whole front of the chest; then the face. She could hardly open her mouth to swallow. The left external jugular vein could be felt like a cord. She gradually recovered under stimulants, beef-tea, and milk.

If, with Simon, we regard fibrin as an exerement, we must conclude that hyperinosis is the result of failure of the excretory function. When there is excess of fibrin, there exists a proclivity to separation of it from the blood-stream. It is liable to be eaught and deposited on any points where the general smoothness of the lining membrane is broken-for example, on the valves of the heart and amongst the columnæ carneæ. It is also subject to clot spontaneously wherever the blood-channel is unusually tortuous, where gravitation has to be overcome, where the vessels are exposed to obstruction and the stream is consequently slow. Acute rheumatism—a disease which offers many instructive points of comparison with puerperal fever—is especially prone to precipitate fibrin on the left cardiac valves. The presence of a second morbid material is probably necessary to eause the fibrinous precipitation. The lactic acid of rheumatism may be the efficient cause. This is a form of arterial thrombosis.

Recovery takes place by gradual disintegration of the thrombi in the veins and lymphatics. This process is analogous to that by which the involution of the uterus is effected. The clots undergo granular fatty conversion, forming a kind of emulsion, or, as Virchow calls it, 'physiological milk.' This is carried into the circulation, and is excreted without creating obvious disturbance. The vascular channels are cleared, and resume practical integrity.

Sequelæ. Amongst the most prominent and persistent is venectasis. Veins that have been over-stretched rarely, if ever, quite recover their pristine calibre; and this is more especially the case with superficial veins of the leg. Hence bundles of varicose veins are formed about the legs and thighs. These

become the seat of slow thrombi long after labour; the blood retarded in the tortuous vessels, especially near the valves, easily coagulates; varicose uleers succeed, and sometimes, when these burst, hæmorrhage ensues. The deeper vessels, being supported by surrounding structures, more easily recover.

A woman who has had phlegmasia dolens once is not exempt from the affection in subsequent labours. The recovery

may be complete.

2. The severe form. The type of this is marked dyscrasia. When, in subjects much depressed by previous illness, bearing some diathetic taint, who are reduced by hemorrhage and protracted labour, septic stuff eapable of exciting thrombosis in fairly healthy subjects enters the uterine veins and lymphatics, the attempt to shut out the enemy by clotting does not succeed. The clots formed are soft, imperfect; the phlegmasia and lymphangitis spread; suppuration takes place; abscesses form in the perimetrium or in the course of the femoral and iliac veins; the whole mass of the blood is invaded and further degraded. In this form the localising power is lost. The poison breaks bounds. It pervades every tissue in the body, and distant suppurations may occur. It undergoes a change, partly chemical, partly necrotic. The course of these cases, to which the term 'suppurative phlebitis and lymphangitis' of Cruveilhier would apply, is rapidly fatal. It is seen most characteristically in lying-in hospitals, or in that most disastrous conjunction, a lying-in ward in a general hospital.

The onset of the disease is marked perhaps by shivering, but there is no decided reaction. The pulse rises to 140, 160, or more, the respirations to 40, the temperature to 104° F. or 105°. The condition rapidly assumes the character called typhoid. The tendency is towards rapid prostration. Delirium often attends, and is the forerunner of death. The history, in short, resembles that of general septicemia, which will be described hereafter. Sometimes the joints are the seat of inflammation, ending in effusions of serous or sanious fluids

or pus.

The danger of embolism is very great in this form of disease, in which there is marked blood-dyscrasia. There is a tendency to rapid breaking-down of the clots, without being converted to assimilable 'physiological milk.' Fragments

large enough to be arrested in the pulmonary capillaries may be swept to the heart.

Pathological anatomy. In the simple forms, when the opportunity of performing an autopsy arises, the following conditions are found in the affected limb. The skin is always thickened; the connective tissue is sometimes found indurated, vascular, infiltrated with serum and lymph. The veins are generally obstructed by clots and inflamed. In the first stage clots alone are formed; there is no inflammation of the coats of the vessels. In more advanced cases, the coats of the veins are thickened, abnormally vascular; the external coat adheres to the surrounding connective tissue; the internal coat is reddened, often studded with fibrinous deposit. The obstructing coagula may now be softened down to a pultaceous mass, often regarded as pus, but which is really the result of fatty disintegration. The veins principally affected are the femorals and iliaes, less frequently the uterine, vaginal, and saphenous. The lymphatics are often enlarged, matted together by condensed connective tissue. The glands are generally enlarged and vascular. The cellular sheath of the arteries is infiltrated; all the vessels are agglutinated by inflammatory lymph.

In the cases in which the septic character predominates, the changes are more general and more distinctive. The clots in the veins are more disintegrated; the presence of pus is more decided in them, and suppuration is common in the perivascular connective tissue and in the pelvis; pus may be infiltrated in the intermuscular connective tissue; the muscular fibres are softened. Peritonitis and metritis are common; there is effusion of serum and pus, and feeble adhesions in the peritoneum. There is often metritis; the ovaries, tubes, and broad ligaments are inflamed, probably exhibiting suppuration. The liver, kidneys, and spleen are congested. The thorax shows pulmonary pleuritis; sometimes hepatisation of the lungs; pericarditis; fibrinous deposits are found in the left heart, perhaps in the pulmonary arteries, with infarction of the smaller branches.

The treatment will depend upon the severity of the case. In all cases the first indication is 'rest.' The affected limb should be laid on pillows in such a way as to favour gravitation towards the trunk. Thus, the foot should be raised; the whole limb should be wrapped in cotton-wool, and this should

be enclosed in oil-silk, so as to prevent contact of air and keep in exuding moisture. In the early stage, when the symptoms are acute, and there is evidence of vital power, we have known six or eight leeches applied to Scarpa's space do marked good. Frictions should be avoided. If the packing do no other good than prevent the nurse from pursuing this favourite but dangerous practice, a great object is attained.

Acupuncture has been tried. We cannot advise it. No

diminution of tension is gained by it.

Dr. Crichton, of Tavistock, speaks highly of the value of sulphate of iron as a local application, in the proportion of 30 grains to the ounce of water, as hot as the patient can bear it.

Can anything be done to favour the solution of the thrombi? We may give quinine, digitalis, and aconite to moderate the heart's action. Ammonia is credited with the property of maintaining the fluid state of the blood. In this way, and as a diffusible stimulant with ether, it is useful. Opium often renders great service. Alcohol must be given with discretion; but it can rarely be dispensed with. Should there be tendency to syncope—and this should be looked for—the subcutaneous injection of ether should be resorted to. Indeed, it is wise to have ether and syringe in readiness for the need which may come suddenly.

We should also be prepared for signs of embolism or cardiac thrombosis.

The treatment of the more severe cases in which thrombosis is defective, merges into that of septicæmia.

Ferric perchloride in combination with quinia finds most useful application.

Arterial thrombosis. In Simpson's collected works (1856) special attention is drawn to this accident in puerpery. A memoir on the subject by Robert Barnes will be found in the 'Obstetrical Transactions' (1863). This deals chiefly with puerperal cases. The writings of Paget, Kirkes, Virchow, Humphrey, Richardson, and Cohn must be referred to for the light which can be thrown upon the puerperal cases by the study of the affection under other circumstances. The puerperal class of cases form but one chapter, although a singularly instructive one, in the history of congulation of the blood.

¹ Brit. Med. Journ. 1871.

The symptoms which announce the disturbance that takes place in the blood are briefly these: At a period more or less closely approaching delivery, the woman is seized with fainting, intense pain in one or more limbs, and arrest of pulsation in them; then follow loss of heat, gangrene, and perhaps death. In all the eases in which this series of events have been observed, which have been subjected to autopsy, clots have been found in the main arteries of the affected limbs.

In another class of eases we witness sudden faintness, irregular action of the heart, distressed breathing, quickly inereasing collapse, and mostly rapid death. In these cases it is found that the pulmonie circulation is almost exclusively concerned, and clot-obstructions are discovered in the right heart and pulmonary arteries.

This is a sketch of a case of arterial thrombosis which came under our care. A lady was delivered easily of her fourth child; the placenta came away entire, the uterus contracted well. She went on fairly for seven days, milk and loehia setting in. On the seventh day, after a violent altercation with the nurse, she got up in bed, perhaps was chilled. She was seen soon afterwards restless, agitated, hysterical, eomplaining of severe spasmodie pains in the abdomen; pulse 120. Next day she was relieved; the pulse had fallen to 100. On the morning of the tenth day the pains had increased; there was great tenderness all over the abdomen, especially in the region of the uterus; tympanites. She felt as if a tight eord were drawn around the abdomen; skin moist, warm; dyspnœa. She could move her legs; there was no tenderness in them, or in the neighbourhood of the large vessels. On the eleventh day the condition was much the same. On the thirteenth day there was pain in the region of the uterus, in the ealf and ankle of the right leg; she suddenly fainted, and on reviving she was seized with the most excruciating pain in the ankle and calf. Pulse 160; great prostration, but the intellect was clear. A few hours later it was found that the leg between ealf and ankle was in a state of gangrene. This quickly extended, and in seven hours from the time it was observed she died.

This case is remarkable as arising under purely puerperal conditions. It is probable that the coagulation took place under the influence of emotion. But in other cases the imme-

diate cause was the detachment of emboli from the aortic valves. From an analysis of fifteen cases Robert Barnes found that the cases might be divided into two classes: 1. Those in which rhenmatism was an antecedent condition; the valves of the left side of the heart presented wart-like excrescences. These become detached, and, carried to the arteries, form the foci of thrombi. In some cases rheumatism was noted before the pregnancy; in others it arose during the pregnancy.

Of the fifteen cases of arterial thrombosis referred to, five were complicated with antecedent rheumatism. The carliest date of invasion was on the second day; the latest seven weeks. In eight cases the indications of gangrene arose in less than fourteen days. In thirteen, death ensued in from eleven days to three months. In two instances recovery took place.

2. Cases not complicated with rheumatism or previous heart-disease. It is probable that in these the clotting began in the left ventricle.

In connection with thrombosis and embolia of the systemic arterial system it is necessary to study these conditions in the pulmonic circulating system. In some instances the two systems are simultaneously affected. In contrasting the history of the two circulations, one circumstance is particularly striking. The left or systemic heart is especially prone to disease, whilst the right or pulmonic heart is rarely affected. In the case of the general system the disease mostly takes its origin in the heart; in the case of the pulmonic system the disease takes its origin mostly in the peripheral veins or larger trunks, whence clots, being carried to the right ventricle, are transmitted to the pulmonary arteries. In certain conditions, however, as puerperal pneumonia, there is reason to believe that primary coagulation sometimes takes place in the pulmonary arteries and arterioles. Adopting the language of Virchow, we may say that in the system of which the left heart is the centre we have primary central thrombosis and secondary peripheral embolia; and in the system of which the right heart is the centre there is generally primary peripheral thrombosis, secondary cardiac implication, and tertiary embolia of the pulmonary arteries.

It may be inferred from the history of the cases of recovery that a collateral circulation may be established, or that, if gangrene be not averted, the necrosed portion may be thrown off. In two cases amputation was resorted to.

Barker relates a case in which recovery followed arterial thrombosis without gangrene. A primipara had measles three weeks before labour. Twenty-five days after labour she was seized with excruciating pains in the foot and heel. The foot became cold; pulsation ceased in the tibial artery. On the fourth day after the attack a feeble pulsation returned in the artery, and in two weeks the patient had recovered.

The pain in the limbs attacked is a striking phenomenon. In the reports special words are commonly used to denote its intensity. In Robert Barnes's case the poor woman begged to have her leg amputated. Fordyce Barker tells a case in which the patient was constantly reiterating, 'Give me something to relieve me or kill me at once.' This pain is noted in non-puerperal cases. Gaspard and Cruveilhier record that violent pain constantly attended injection of foreign substances into the arteries, whilst injection into the veins was painless. Pain generally subsides when the mortification appears; and cessation of pulsation in the arterial trunks leading to the affected limb, loss of sensation and heat quickly follow.

Emboli may also be carried to the brain, liver, kidneys, spleen, walls of heart, and the eye. Burrows relates a case (Simpson's works) in which hemiplegia suddenly appeared six weeks after delivery. Abundant vegetations were found on the aortic and mitral valves. The left corpus striatum was reduced to a diffluent pulp, and the branch of the left middle cerebral artery passing to this part was obliterated by a small mass of fibrin. The artery beyond this obstruction was impervious. Barker relates another case: A primipara was taken two days after labour with a chill and febrile symptoms; the catheter was required. Seven days later she seemed convalescent; but on the eleventh day the temperature rose to 105°, the pulse to 124; on the twelfth day aphasia set in. She died the sixteenth day after labour. Autopsy: Left middle cerebral artery contains a firm white clot at its first bifurcation; vegetations on the mitral valves; spleen three times the usual size; wedge-shaped infarction at upper part; artery going to this obstructed by whitish thrombus.

Barker relates another case diagnosed as cerebral embolism

which recovered, and a third ending fatally. It is full of interest; want of space forbids transcribing. A small artery leading from the middle cerebral was found obstructed by a reddish-grey coagulum; there was a mass of vegetations on the mitral valves. Barker points out that, in cerebral embolism the symptoms of hemiplegia and apoplectic seizure are almost always suddenly developed; whereas in cerebral hæmorrhage these symptoms are generally developed more or less slowly—that is, one after another.

Pulmonary thrombosis or embolia. Of fourteen fatal cases, analysis shows that in six there were clots in the peripheral veins, crural, iliac, hypogastric or uterine; and also that signs of phlebitis or of metritis preceded, often by long intervals, the signs of lung-distress. The first or peripheral symptoms arose in from one to three days after labour; the secondary or pulmonic symptoms occurred at various periods, from four to more than twenty days after labour; death occurred in from ten to twenty-eight days after labour. In eight cases the death was more or less sudden; in these it was generally found that not only were the main branches of the pulmonary artery filled with coagula, as well as the smaller ramifications obstructed, but that clots existed in the right heart. In the cases in which death was more gradual the symptoms of pneumonia were developed.

In those cases in which either minute portions of thrombi are taken up from the peripheral veins, or when the septic or ichorous matter is less virulent, no clot may form in the right heart, but minute emboli may be carried into the finer divisions of the pulmonary artery, causing lobular pneumonia, ending in slower death, and even in recovery.

Pure thrombosis of the venous system—that is, uncomplicated with marked blood-dyscrasia or fever—is not often fatal. It can only become dangerous when portions of peripheral clots are carried to the heart.

Diagnosis. The symptoms briefly summed up are characteristic. They are clearly distinguished from syncope by the terrible dyspnæa and the prescrvation of consciousness—conditions which are not observed in syncope.

Is the thrombosis in the right heart and pulmonary arteries always the result of embolism?—that is, must we postulate, as

a necessary antecedent condition, peripheral thrombosis, as in the crural veins, whenee emboli are supplied and carried to the right heart? That this is generally true, dissections prove. Another question arises: Is thrombosis in the right heart and pulmonary arteries frequently or ever spontaneous—that is, primary, not being preceded by embolism? This question has been discussed by Playfair. Analysing twenty-five cases of sudden death after delivery, he stated that 'cases of spontaneous thrombosis and embolism might be divided by a clear line of demarcation, depending on the period after delivery at which the fatal result occurred. In seven there was distinct evidence of embolism, and in them death occurred at a remote period after delivery; in none before the nineteenth day.' On the other hand, in fifteen eases out of the twenty-five, with one exception, death occurred before the fourteenth day, often on the second or third day. The explanation submitted is that in the embolic eases time is required for the disintegration of the peripheral thrombus which supplies the emboli; whereas, in the so-called spontaneous heart and pulmonic artery thrombosis, the formation of the thrombi corresponds in time, and to a great extent also in cause, to the ordinary peripheral thrombosis. Playfair enforces this hypothesis by citing cases in which signs of pulmonary obstruction showed themselves without proving immediately fatal, and shortly afterwards peripheral thrombosis, phlegmasia dolens of one extremity, commenced.

The argument is strong, and is no doubt generally true. Playfair's analysis agrees with that previously made by Robert Barnes. Exception might be taken to the term 'spontaneous.' The thrombosis is, strictly speaking, not spontaneous in any ease. We believe that in all cases the cause of the original or primary thrombosis, whether in the periphery or in the heart or pulmonary arteries, is like in nature. The immediate cause is the invasion of the venous blood by noxious matter. It is in accordance with clinical observation that the vessels most immediately in relation with the source of the offending matter will most frequently be the seat of thrombosis; and according to the views we have stated as to the conservative purpose of thrombosis, the offending matter is thus commonly barred from reaching the heart in any serious quantity. But this conservative attempt is sometimes thwarted. Noxious stuff, whether it

be in the form of ichor, septic matter, or possibly minute fragments of half-dissolved thrombi in the uterine sinuses, may run through the hypogastric and iliac veins, reach the heart and pulmonary arteries, and there cause primary thrombosis. When this occurs the issue is commonly so rapidly fatal that there is little or no opportunity of observing the order of events, such as we possess in the case of peripheral thrombosis, where the disease does not involve vital organs or functions. In some cases, however, notably those of pneumonia from infarction, the natural history of primary pulmonic thrombosis may be followed throughout.

Virchow thus describes lung thrombosis and capillary embolia:—

In the pulmonary artery the introduced fragments of thrombi penetrate to different depths according to their size. Usually a fragment sticks fast where a division of the vessels takes place. Very large fragments may block up trunks of the pulmonary artery, and instantaneous asphyxia ensues; other fragments penetrate into most minute arteries, and there give rise to very minute and sometimes miliary inflammations of the parenchyma: this is *capillary embolia*.

Capillary embolia is also observed in other organs. Thus, endocarditis not seldom forms the starting-point of metastases. Ulceration takes place in one of the valves of the right heart; crumbling fragments of the surface of the valve are borne away by the stream of blood, and are carried to far distant parts. The kind of obstruction which these masses produce is altogether similar to that which the thrombi in the veins give rise to, but they present a different chemical constitution. Their minuteness also and their friability favour their penetration into the smallest vessels; therefore we not unfrequently find an obstructing mass in minute microscopical vessels. This mass constantly presents a finely granular appearance, and does not consist of coarse débris such as we find in the veins, but of a very fine yet dense granular matter; chemically, it possesses the property of great resistance to ordinary tests, and so is readily distinguished. This is capillary embolia, properly so called. It frequently gives rise to minute deposits in the kidneys, spleen, and substance of the heart itself; in certain cases it causes sudden occlusion of the vessels of the eye or brain, and, according to circumstances, produces metastatic deposits or sudden functional disturbances, as amaurosis or apoplexy. This condition is quite distinct from primary arteritis. We must not, however, accept too absolutely the theory of embolism. The contending theory of inflammatory blood demands consideration. Thus, Schroeder contends that embolism does not account for the changes observed after death. In acute fatty degeneration of the liver, parts remain normal; in the case of the spleen, the entire organ is often converted to pulp, but circumscribed morbid foci are sometimes found. In the kidneys also, and

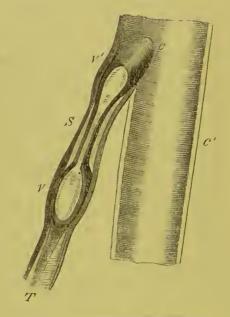


Fig. 52.—Thrombosis of the saphena vein.

s, The Saphena; T, Thrombus; V v', Thrombi on valves in process of softening, and connected by thinner and more recent coagulum; c, Prolongation of plug into c' Femoral vein. (After Virchow).

heart, muscles, and connective tissue, are circumscribed inflammations, the origin of which cannot be ascribed to embolia. And when we look at the inflammations of serous membranes, of the arachnoid and joints, which can only be explained by the phlogogenous property of the blood, one cannot doubt that altered blood may cause inflammations without mechanical admixture. The history of pulmonary thrombosis from embolism is distinctly traced in the following illustrations from Virchow. Commencing with fig. 52, we see a thrombus of the saphena vein, one end projecting into the femoral

veins. This thrombus shows two points of softening or liquefaction into 'physiological milk.' It is easy to understand how the liquefied portions at VV' might burst into the femoral rein, and be carried into the circulation in the form of granular embola. Thus we may have capillary embolism, or the granular matter may be assimilated without perceptible disturbance.

Next, in fig. 53, we see autochthonous or original thrombi, cc', in varicose lateral branches projecting into the femoral vein C; t is a prolonged thrombus produced by concentric leposits from the blood; t' is a similar thrombus, from which

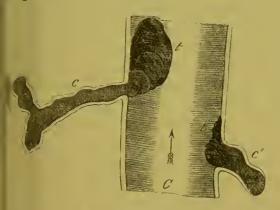


Fig. 53.—Autochthonous and prolonged thrombi.

c', Varicose lateral venous branches, filled with autoebthonous thrombi, and projecting into the femoral vein c; t. Prolonged thrombus produced by concentrically apposed deposits from the blood; t', Prolonged thrombus from which fragments have been detached. (After Virchow.)



Fig. 54.—Embolia of the pulmonary artery.

P, Branch of the pulmonary artery dividing at E, where the embolou is caught and sits astride; tt, the capsulating secondary thrombus. (After Virebow.)

ragments (embola) have been detached and carried into the irculation. The arrow indicates the course of the circulation.

Lastly, in fig. 54, we see the ultimate stage of embolism producing thrombosis in the pulmonary artery. P is a noderately large branch of the pulmonary artery; E is the ork or bifurcation of this artery, upon which the embolon has been caught, and arrested there, blocking more or less combletely the vessel. Secondary thrombi, $t\,t'$, are found encapsuating the embolon, which has been swept along in the torrent t the venous circulation from t', in fig. 53.

To show how compensation is effected in lung-obstruction recite from Paget ('Med. Chir. Trans.' 1846), who thus xplains how the equilibrium between the systemic and the

lung-circulation is disturbed, and how compensation is sometimes effected:- 'For the avoidance of either general or pulmonary congestion, it is essential that equal quantities of blood shall in a given time pass through the systemic and pulmonary circulations respectively. In the case of an obstruction of the pulmonary arteries of small extent, the right ventricle will naturally increase the velocity of the blood which it propels through the remaining open arteries; if the quantity thus sent through the lungs be duly kept up, no change will be needed in the systemic circulation. But when many and large branches of the pulmonary artery are obstructed, and the usual quantity of blood cannot be transmitted, then the balance between the two circulations can be maintained and congestion avoided only by the movement of the blood through the systemic vessels being retarded. And this adjustment will be naturally effected—for when the left ventricle receives, through those pulmonary arteries which remain open, a smaller than usual quantity of blood at each dilatation, it must at each contraction discharge an equally small quantity. Hence a diminished velocity of blood through the systemic vessels.

'The peculiarity, therefore, of a person who has a considerable portion of his pulmonary arteries obstructed must be that, in direct proportion to the extent of the obstruction, his systemic circulation is less rapid and his remaining pulmonary circulation more rapid. The patient may thus live for a time without serious discomfort, though with great danger. For if coagulation and obstruction increase, the retardation of the blood in systemic vessels must increase. And this will go on until the blood so nearly ceases to flow in the systemic vessels that the action of the heart and nervous centres are no longer maintained, and thus the patient suddenly or slowly dies. It thus appears that the direct cause of death is not in the state of the lungs, but in that of the brain or of the heart.'

Treatment. In the systemic arterial thromboses there is little experience to stimulate the hope of successful treatment. We must look to the possibility of keeping the patient alive long enough to permit the establishment of collateral circulation, as in aneurism, or to favour separation of the necrosed limb. There is a case of a woman who survived after spontaneous amputation of the limbs. The great principle of rest is of

irst importance; injections of ether; good nourishment; perhaps ree administration of ammonia, on Richardson's hypothesis hat fluidity of the blood depends upon alkalinity, may be ried.

Might not intra-venous injection of an alkaline saline be

In many cases some mental emotion or sudden exertion has mmediately preceded the cardiac and pulmonic distress. The conclusion seems justified that, in some of the cases, the fatal atastrophe might not have occurred had the patient been kept n a condition of mental and bodily repose.

The most hopeful treatment must be sought in prophylaxis; n the earnest study of the causes—remote and immediate. Ience all that has been said as to the care of the gravida nd puerpera is emphasised by the probability of thrombosis if he blood become degraded, and if septic matter get into the eins. During labour care should be taken to ensure due and egular contraction of the uterus, avoiding 'kneading,' which but another name for bruising. Stimulants, bark, and the nineral acids are, in our experience, the most useful medicines.

In two cases that recovered under our observation we are npressed with the belief that the happy issue was mainly due the application of leeches over the præcordia. Prompt relief as observed. A small bleeding at the arm may also, by iminishing the flow to the right heart, help to keep the quilibrium between the pulmonic and systemic circulations. 'here is a natural process of cure if the patient can only be ept alive long enough for this to be carried through. In some ases it has been proved that the obstructing clot had been resent for some time before death. As Paget says, citing case: 'A great part of the pulmonary circulation may be crested in the course of a week without immediate danger life or any indication of what has happened.' The hope, nen, is justified that, under absolute rest, sufficient circulation may be kept up to sustain life whilst the clot is undergoing osorption. But any sudden exertion may at any moment row upon the damaged circulation a strain too great to bear. hus it is a common history that death has been precipitated y some slight exertion, as of sitting up in bed.

Putrid infection. This is commonly a form of autosepsis,

but it may be complicated with exosepsis. It is usually due to the retention in the uterus of some decomposing substance, as a dead fœtus, a mass of placenta, or clots. The local signs are masked by the general symptoms. Sometimes there is tympanites of the uterus: physometra. There is rarely any degree of inflammation. The condition is essentially empoisonment by the absorption of foul gases or foul fluids. The empoisonment is sometimes slow and continuous; sometimes rapid, almost sudden. The first thing noticed is the change in the lochia. For some days the flow may be normal; then it becomes less copious, and brownish black, mixed with more or less sanious débris. Sometimes hæmorrhage of black blood, offensive, and containing bits of placenta or membranes, occurs. Shivering commonly marks the onset, then fever. There is no marked sensibility to touch. Examination will show that the uterus is enlarged; the cervix is often gaping; some débris of clots and offensive discharge come away when the finger is withdrawn.

Rigors are often recurrent, followed by renewed febrile movement, so long as offending stuff remains in the uterus to feed the flame. If the offending matter is removed from the uterus, so as to cut off the supply of poison, improvement is sometimes rapid, and recovery is not protracted. But in other cases depression becomes more marked; diarrhæa and sweating persist; the pulse and temperature rise; delirium, perhaps coma, precede death.

This form of fever has no distinctive morbid anatomy, although in some cases, perhaps, those complicated with exosepsis, phlebitis, and metro-peritonitis may be observed.

The following is a typical case: A pluripara at the seventh month showed signs of the fœtus being dead. We delivered a decomposed fœtus by turning; it was with great difficulty that the fœtus was brought away entire. It showed the development of six months; it had probably been dead some weeks. The placenta was removed by the midwife. There was no hæmorrhage. On the fifth day the patient was reported as suffering from pain in the abdomen. On the ninth day the abdomen was excessively distended and painful all over; the pulse was small. She died next day. Autopsy: Lungs generally healthy, save a little chronic tubercular mischief. The

abdominal cavity was full of purulent fluid; universal peritonitis; liver and spleen congested; right kidney completely disorganised, weighing scarcely an ounce; the left kidney was very large, pale, granular. The patient had not had dropsy or convulsions. The mucous membrane of the stomach was intensely congested. The uterus enlarged, covered with recent lymph; its substance vascular, but not highly inflamed; its cavity contained some blood, and a small bit of placenta adhered between the openings of the tubes. The left tube was full of pus.

Physometra, or tympanites uteri. Under certain conditions the uterus may become distended with gas or common air. That air may be sucked into the uterus when flaccid and the abdominal walls are relaxed, so that the uterus, bagging down, creates a vacuum, is certain. It may also enter along with the hand introduced for the removal of placenta or clots. But what is understood by physometra is commonly due to putrefactive changes in the uterus, as when fœtus, placenta, or clots are retained. In some cases the os uteri is occluded by the placenta falling over it; then the imprisoned gases accumulate, the uterus is distended, and it may even give a tympanitic sound on percussion. Commonly, signs of septicæmia, due to absorption of foul gas or fluids from the uterus, attend. Some portion of the gas escaping under the uterine tension, a peculiarly offensive odour is perceived. An offensive vaginal discharge is also frequent. It is developed quickly after labour. There is a sense of tension, simulating pregnancy; uterine colics are common.

Pressure-symptoms, due to the enlarged uterus, become prominent in proportion to the size of the organ; the bladder is liable to compression and paralysis; the breathing is oppressed.

When internal examination is made, the fingers, passing the cervix, feel the occluding mass. The moment this is shifted from the os, fœtid gas rushes out, perhaps is heard, is certainly smelt, for the room is quickly filled with an intolerable stench.

Probably, when the uterus has been cleared and washed out with plain water or disinfecting fluid, the septicæmic symptoms will be relieved. But sometimes the empoisonment or other complications are so severe that fever continues and is intensified.

In some cases the tympanites is started during gestation,

as when a dead feetus is retained. Until the utcrus is cleared there can be no safety.

When the condition is due to retained fœtus, liquid is commonly added to the gas, constituting physohydrometra. Foul discharges of bubbling gas and fluid commonly attend this form.

Becquerel has given a good description of the affection. Staude analysed 64 cases; of these, 32 died, 18 had severe puerperal complications, and 14 recovered without special disorder.

The dorsal decubitus, the uterus firmly supported by a binder and pad, are important measures in treatment. The general treatment falls within the rules which govern the treatment of puerperal fever.

Course, characters, and diagnosis of pelvic inflammation. In the simple traumatic cases, or those in which the septic element is inconsiderable, plastic lymph is rapidly thrown out in the broad ligaments and in Douglas's pouch. The immediate effect is to set the uterus fast. On examination by vagina the uterus is found 'set' lower in the pelvis than natural; the vaginal-portion is fixed on one or both sides, and generally also behind. This depends upon whether one or both broad ligaments and the retro-uterine peritoncum be involved. Sometimes the effusion fixing the uterus so pushes down the fundus of the vagina that the os uteri is flush with the roof of the vagina; but in other cases the effusion causes a circular or half-circular projecting collar round the vaginal-portion. These observations establish the diagnosis.

In such a case recovery by resolution may occur. The swelling seems to melt away, but adhesions are apt to be left for some time after.

The onset and progress of the disease is attended by the ordinary symptoms of fever and by pelvic pain. The legs are kept at rest to lessen this pain.

Abscess. In a large proportion of cases suppuration takes place. McClintock, out of 87 cases, found 37 end in suppuration, with discharge of pus; 24 burst or were opened externally; 6 discharged through the vagina, 5 through the anus, and

¹ Maladies de l'utérus, vol. iii.

² Zeitschrift für Geburtsh. u. Gynäk. Band. iii.

2 into the bladder. It is also possible, but very rare, for the abscess to burst into the peritoneum. It is in high degree probable that the termination in suppuration is often overlooked. Escape by the vagina or rectum is, in our experience, more common than that noted by McClintock.

If there be septicæmia, if the patient be strumous, or lymphatic, or syphilised, if she be reduced by hæmorrhage, the probability of suppuration is vastly increased. The advent of suppuration is commonly marked by recrudescence of fever. Rigor occurs; the pulse is lowered; sometimes vomiting is noted; and when there is septicæmia, the poison, like most others, is carried to the intestines and sets up diarrhæa.

If the abscess be fairly evacuated, spontaneously or by art, a marked amendment takes place quickly. But suppuration may go on for weeks. In some cases only temporary relief is found. The hard tumefaction subsides slowly. Hectic or irritative fever persists. Successive purulent collections may discharge, and it is hard to foretell the end. The patient may sink from exhaustion and chronic pyæmia.

Occasionally the abscess, if formed in Douglas's pouch, may become encysted or isolated by effusions which shut it off from the general peritoneal sac. The imprisoned pus may even undergo a transformation which ends in absorption, and it is converted into a cretaceous mass, which persists, latent or passive, for a long time, and may only be detected long afterwards on post-mortem examination. We have seen such cases. Duncan says he has repeatedly opened latent abscesses.

In some cases, when the bulk of the effusion has melted away, there remain cellular adhesions, which may restrain the movements of the uterus, binding it down in various directions. Slowly, perhaps, but pretty surely in the long run, these adhesions disappear. They possess no great vitality. When put upon the stretch, as they are sure to be, under the varying movements of the pelvic organs, their feeble organisation is destroyed. We are constantly seeing cases where the patients have assured us on the authority of others that the womb was bound down by adhesions, and where, nevertheless, we find no great difficulty in moving the womb out of the pelvis. The retroflected fundus, enlarged, is simply locked under the sacral promontory.

Another effect of effusion surrounding the uterus is that its due contraction and involution are impeded. The cervix is kept open. Hence the liability to hæmorrhage at the time, and to menorrhagia later.

The bladder symptoms are often distressing, but this is not constant. There is dysuria, a frequent call to micturate, and an unsatisfied sense of the bladder not being emptied. This distress is partly due to the interference with the contractile action of the bladder and with the abdomino-pectoral act of expulsion, and partly to the irritating quality of the urine. This is often loaded with lithates and mucus. If an abscess be about to burst into the bladder, the dysuria increases, and commonly there is retention. When the abscess has burst, of course, there is pus in the urinc. Retention may also precede the bursting of an abscess into the rectum or vagina.

The secretion of milk is generally snspended, either quickly or gradually.

When the condition has become chronic and the patient gcts about, she walks with a characteristic limp. The walk is enough to suggest a diagnosis. Sciatica on the side affected is not uncommon.

There are four varieties of peritonitis which in many points resemble pnerperal pelvic peritonitis, and which are sometimes associated with it. One is perityphlitis; the second is a localised adhesive peritonitis occupying one iliac fossa; the third is peritonitis of the lower part of the abdomen from cancerous affection of the pelvic organs and lumbar glands; the fourth is tubercular peritonitis. The diagnosis from cancerous inflammation or deposit is important to make. A broad distinction lies in the fact that cancer generally invades the cervix itself, whilst simple inflammation mostly seizes the surrounding tissues.

The question of diagnosis may be appropriately concluded with the caution not to pursue it at the bedside with too much diligence. By repeated and minute examinations it is very easy to do harm. Nothing in the treatment is so necessary as 'rest' of the affected parts; and examinations imply disturbance.

The treatment must vary according to the type of the case and the complications. If the case be one of metritis

associated with septicemia, the treatment of the perimetric inflammation is simply subsidiary to that of the puerperal fever. In the more purely inflammatory cases, leeches to the number of twelve to the groins and hypogastrium will generally be useful in the early stage. Fomentations give some relief. An excellent plan is to smear a bit of lint large enough to cover the hypogastrium with an ointment composed of extract of belladonna one part, mild mercurial ointment three parts, and vaseline six parts; to lay this over the region affected, and over it a layer of absorbent cotton-wool. A few doses of calomel and opium may do good. If diarrhea ensue, Dover's powder should be resorted to. In ordinary cases salines are useful at first, then opium, digitalis, aconite.

In the more chronic stages blisters are often serviceable. Then quinia or bark or iron come into use.

The question as to opening an abscess is often solved by Nature; but generally it is well to come to her aid by opening it ourselves. The proper time is as soon as fluctuation is made out. The opening should be sufficient to admit a drainage-tube. The walls of the abscess-cavity should, as far as possible, be kept in contact by well-adjusted compresses. If the abscess be opened in the groin, a bistouri is best; if the indication is to open by rectum or vagina, a long trocar is convenient. We have contrived a long tube carrying a knife, which can be projected when the spot to be punctured is reached. This tube can be fitted to an aspirator, and will carry a drainage-tube.

Puerperal peritonitis, distinct from perimetritis; peritonitic puerperal fever. Peritonitis may be the apparent condition of puerperal fever, or it may be an epiphenomenon or complication of other conditions. As a general rule, inflammation of a serous membrane postulates an already existing morbid affection of the organs invested by the membrane, or toxemia. A pure 'idiopathic' peritonitis is difficult to realise under any circumstances. In a puerpera this is impossible, for her blood, however sound in a theoretical sense, is always in a state of transition, charged with excess of excrement, a condition favourable to the production of inflammation. With this qualification we may accept the term 'simple puerperal peritonitis.' A puerpera may seem to be progressing favourably for several days after labour, and to have passed the period of

danger, when a severe rigor, followed by acnte pain in the abdomen and a moderate rise of temperature and pulse and dyspnœa, are observed. These symptoms, however, most frequently occur about the third day, which seems to be the epoch of greatest susceptibility to injurious influences. Frequently, inquiry will elicit the fact that the patient has been exposed to cold, as from getting ont of bed. In not a few cases we have been convinced that the exciting cause was the free use of cold water, perhaps ice, to the abdomen, external genitals, and by intra-uterine injection to check hæmorrhage. This history means checked secretion and excretion—that is, the retention of stuff in the blood that should be excreted. The noxious stuff carried in the circulation acts by predilection upon the tissues which have been recently the seat of intense physiological energy, perhaps injury. Thus inflammation is apt to be kindled in the peritoneum, although perhaps the uterns and perimetric tissues are more commonly attacked first. attack is almost invariably ushered in by a rigor. Then follows pain, acute, agonising, referred to the nmbilical, hypochondriac, hypogastric, or iliac regions. The whole snrface is exquisitely sensitive to touch; the patient shrinks from palpation; even the weight of the bed-clothes is distressing. The patient almost invariably lies motionless on her back, the knees drawn up. The pinched, drawn face indicates anxiety and suffering. The pain is usually mitigated after one or two days. But sensitiveness to pressure remains in limited points. This subsides when tympanites sets in and scro-fibrinous exudation takes place. The pulse rises in frequency, to 120 or more; it is hard, but generally becomes feeble when the case is doing badly. The temperature rises to 103°, 104°, or more. tongue may remain moist and clean throughout, but mostly it becomes coated, yellowish, clammy, and soft, showing the impressions of the teeth. Then, especially in severe cases, the tongue becomes brown and dry, and the teeth are covered with sordes. The appetite is gone, and thirst is distressing. Sometimes hiccongh, vomiting, and diarrhœa attend. Hervieux and Barker note the excessive predominance of bile in the evacuations. Tympanites rarely fails; its amount is commonly proportionate to the severity of the disease.

The distension of the abdomen causes or aggravates

dyspnœa. In the initial stage of acute inflammation the respiration is short, rapid, thoracic. Later it may become more abdominal, but still it is hurried, as in all cases of fever, keeping relation to the rise of temperature and pulse. The respirations at this stage are 40 to 50 in the minute. In the simpler cases the mind is not much disturbed. Pain and anxiety predominate.

In the more severe cases, in which the toxemic element is more marked, the preceding symptoms are intensified. The eyes become sunken and surrounded by a dark areola, the cheeks hollow, a hectic spot shows, and the general aspect is darker. The brain becomes oppressed; the expression is dull, or, as Barker says, it is that of absent, dreamy reverie.

Effect upon the puerperal functions. The milk is sometimes, but not always, arrested. We have known it to return after long suspension on recovery. The lochia, in like manner, are not always arrested. When they assume an offensive puriform character, complication with uterine inflammation is indicated.

The duration and issue of the disease depend upon the character of the affection, and the resisting power of the subject. The more simple the inflammation, the greater the prospect of healthy resolution and recovery. In the more simple cases the severity of the symptoms subsides in a few days. But if there be much effusion, especially of a cacoplastic quality, the case is likely to end fatally within a week or fourteen days. Relapses are especially to be apprehended.

In the more severe cases the peritonitis is mostly secondary upon metritis, phlegmasia, lymphangitis, and is an extension from pelvic inflammation. The history of such cases merges in that of these inflammations.

Treatment. We are here chiefly concerned with the simple forms of peritonitis. The treatment is local and general. The first indication is to relieve pain. This is to be attempted by opium. It must be given freely, on the principle long ago taught by Stokes, and Graves, of Dublin. It is strenuously advocated by Barker as the chief remedy. Opium is the great agent in securing 'rest' of the parts inflamed. It quiets peristaltic action, and by allaying pain laps the patient in sleep and tranquillity. It must be given boldly and perseveringly.

It may be given in the form of pill, a grain every two hours. or twenty or thirty drops of liquor opii, or solution of morphia, or by subcutaneous injection, and by enema in drachm doses of laudanum, if there is diarrhea. Barker insists that it may be necessary to continue the use of opium for a week or more: the tolerance of the agent diminishes as the disease recedes. This, he says, is an infallible guide as to the measure in which you can reduce the quantity and diminish the frequency of the dose.

The next indication is to lower vascular tension. The most efficient means of doing this is by bleeding. This remedy is out of fashion; but we are sure we have seen decisive relief from the abstraction of twelve ounces of blood from the arm, and in other cases from twelve to twenty leeches to the abdomen. The cases in which this measure is admissible are those of simple inflammation, and in the earliest stage before effusion takes place.

In the cases now considered, a half-grain dose of calomel every four hours in combination with opium is often of singular efficacy. This is more especially the case when there is accumulation of fæcal matter and sluggish liver. When the intestine is loaded, spasm, wind-colic, with tenderness on palpation, or rather the dread of being touched, we have a condition figuratively called 'false peritonitis.' In this condition there is always some degree of copræmia from the absorption of fæcal matter or gases from the intestine. Small doses of calomel frequently bring speedy relief.

Another means of lowering vascular tension is by purging; but this is forbidden by the necessity of keeping the abdomen at rest. And purgatives are out of harmony with opium. We are in the habit of combining digitalis with opium. Barker relies much upon veratrum viride, commencing with five drops of the tincture. It sometimes lowers the pulse in a remarkable manner. Our experience of this is limited, as we have mainly relied upon digitalis, aconite, and bromides. In the complicated forms, quinia must have a prominent place.

The tympanites and diarrhea are often much relieved by turpentine. This may be administered by enema, in combina-

tion with laudanum.

It is also useful in the form of stupes to the abdomen.

Flannels are wrung out of hot water and turpentine sprinkled upon them.

Alcohol is of special service in the lower types of the disease,

and in the more advanced stages.

A few vaginal and uterine injections of carbolic acid, 1 in 50, at 105° F., should be used, so as to obtain the certainty that there is no source of irritation in the uterus. But since this operation involves some disturbance of the patient, it must be practised with all gentleness and skill, and the physician will do well to carry it out himself.

As much nourishment as can fairly be tolerated should be

given.

Colpitis puerperalis or vaginitis may be mentioned in this

connection as an accident of puerpery.

The ordinary form may be nothing more than an excess of the normal hyperæmia attending labour, aggravated by the traumatism of that process. There is intense hyperæmia; rapid shedding of the epithelial layer, sometimes leaving the mucous membrane bare of this element of its structure. This condition is attended by great pain. It is quickly relieved by hot water injections, the efficacy of which is increased by the addition of a little acetate of lead. In other more severe cases, in which the crushing of the vaginal canal under severe labour is great, sloughing may take place, to be followed by granulation and cicatricial atresia.

The vagina may, however, be attacked by erysipelatous, eroupous, or diphtheritic inflammation. This may even proceed to gangrene, or, being a local manifestation of a general infection, may end fatally. Thus it is in forms distinguished by German and Russian physicians, in whose hospitals cases of this nature most commonly occur, as Colpitis traumatica, C. gangrænosa, C. diphtheritica. We have, however, seen the diphtheritic form in private practice.

Metritis. Beginning with the focus of physiological activity, it may be expected that the organ which is most predisposed to inflammation, which receives the first attack—the uterus—will be the first to suffer from inflammation. This form may be autogenetic or heterogenetic. There can hardly be a doubt but that, in the first instance, inflammation may be concentrated in the uterus. But it rarely stops there.

Continuity by vessels, venous and lymphatic, and contiguity of tissues, will rapidly carry the inflammatory process to surrounding parts. Still, it is useful to recognise, if only theoretically, that there is a stage, however short, in which simple metritis may exist. The early suspicion of this stage may dictate treatment at the nick of time when there is the best prospect of limiting the disease.

After-pains give the first warning. Of course these do not necessarily signify metritis; but if conjoined with febrile symptoms, the diagnosis of metritis receives confirmation. In primiparæ, who suffer comparatively seldom from after-pains, metritis may break out suddenly without warning, in the midst apparently of good health. In multiparæ, on the other hand, after-pains are rarely wanting. They commonly subside spontaneously or under sedatives in from thirty to forty hours; but when inflammatory complication is arising the pains persist and resist all treatment. Then the uterus is heavier, painful on touch, hard, and tense. This condition declares itself on the third or fourth day. Then pain, fever, rigors set in.

The process of involution is arrested. The lochia are usually suppressed. The vagina is felt hot, soft, painful. The uterus is less mobile. There is a sensation of fulness and doughiness in the region of the broad ligaments; touch here brings pain. This signifies that there is already a beginning of peri- and parametritis.

At this point the disease may stop and recovery ensue. But it too commonly spreads, and the case merges into metro-peritonitis or other graver forms.

Then we have the *suppurative metritis*. This is frequently heterogenetic. In this case all the tissues of the uterus are involved. The fever becomes more intense and persists. There is general infection; and, except for the local inflammation, the case can hardly be distinguished from septicæmia. Diarrhæa sets in. Death is not long delayed.

A third form is described by those who have drawn their pictures from observation in hospitals. This is the gangrenous metritis. The description is correct. But we think it necessary to point out that the lower segment of the uterus, cervix, and even the vagina, parts which have undergone the bruising of labour, present a rough, dark, even black, soft appearance.

This is not gangrene; the condition is superficial, and had probably little to do with the patient's death. In some cases, however, there is true gangrene.

This form is usually marked during life by the intolerable feetor of the discharges. A large ward may be poisoned by them. Prostration is rapid and extreme. The features are sunken and inanimate. There is a tendency to rapid loss of heat. The face, at first pale, becomes patchy, the lips blue, the eyes dull; there is almost constant low delirium; the abdomen is tympanitic, hardly sensitive to pressure; the uterus is very large. Few women recover.

Next comes puerperal metro-peritonitis, also frequently heterogenetic. This condition is sometimes no more than an extension of metritis. It usually declares itself early—that is, on the second, third, or fourth day. The attack is often sudden, or the prodromic stage is so insidious as scarcely to attract attention. It is commonly ushered in by rigor, generally single and lasting half an hour or more, and very severe. Violent febrile reaction follows. Acute pain quickly follows in the abdomen. The pain, although general, is more marked at the sub-umbilical region and in either side of the uterus at the seat of the broad ligaments. The pain is much aggravated by pressure, and is marked by fits of exacerbation. This pain generally subsides in two or three days; but this, unhappily, is no ground for a favourable prognosis. It is rather an indication of advancing depression. Tympanites comes with the pain, due to the accumulation of gas in the paralysed intestines. Indeed, the outlines of the intestines may sometimes be traced out under the skin. Fever is marked; the pulse and temperature rise. But after a time the temperature often falls remarkably. As Wunderlich remarked, sub-normal temperatures are especially frequent in peritonitis, and are always of grave import. Death often happens in this condition. Vomiting and diarrhea are frequent attendants. Dyspnæa sets in. This is due partly to the tympanites, but frequently pericarditis and pleurisy complicate, and add to the oppression of the lungs. Even pneumonia and small apoplectic effusions occur. The mind is not always greatly disturbed at first, but delirium commonly precedes death. The facies Hippocratica is a marked condition.

The milk secretion is arrested; the lochia are commonly suppressed. The involution of the uterus is stopped. Profuse perspirations set in, and sometimes eruptions of sudamina. Often also miliary, pustular, and bulbous eruptions or erythematous patches appear; and occasionally gangrenous eschars are formed on the labia vulvæ and buttocks.

In the more severe cases, such as occur in hospitals, the termination is but too usually in death. In the rare cases of recovery, the inflammation can hardly have been extensive; the disease seems to seek localisation in arthritis.

Diffuse inflammation of the connective tissue is not uncommon as one of the issues of puerperal toxemia. Probably in some cases the form of toxemia was erysipelas or scarlatina; but in some cases we have been unable to trace this association. Abscesses form in various parts of the body; sloughs may follow, baring the muscles. In some cases sloughs of necrotic kind form on the back and nates. We have found bark, amuionia, quinia, iron, good nutriment effective; and, locally, dressings with carbolised oil have been singularly useful in promoting healthy grauulations and healing. A solution of bichloride of mercury, 1 in 2,000, is perhaps better. When the skin is unbroken it is the best means of preventing bed-sores. When the toxemia leads to this peripheral localisation there is a fair prospect of recovery; the disease may be regarded as wearing itself out. The indication is to sustain the patient's strength under the trial.

Diffuse inflammation of the voluntary muscles. In some cases, inflammation of the connective tissue involves inflammation of the muscles. This is seen in the legs and arms. The fine areolar tissue running between the muscular bundles may be the chief seat of the disease, but in some cases, as Virchow has described and figured, the muscular fibres themselves are attacked. They undergo softening, and share in the sphacelus of the connective tissue. Possibly this form of muscular inflammation and softening may be promoted by the chemical changes wrought in the muscles by the intense efforts of labour (see p. 415).

Ophthalmia is observed as a complication of some cases of puerperal fever. The whole globe of the eye is attacked; destructive sloughing takes place. The cases we have seen

were traced to scarlatina. But it is probable that the affection may also arise from erysipelas. It is a complication of bad omen. It precedes the darkness of death. But we have known recovery, with the loss of sight.

Miliary puerperal fever. The characteristic features of this disorder are a copious, minute, vesicular eruption, first appearing on the forehead, chest, and arms, and then extending to the whole surface of the body. The vesicles are distinct, surrounded at the base by a narrow red circle.

Under moderate care and the use of bark and acids the disease is generally controlled.

We have seen examples of it. It is undoubtedly an artiicially engendered disease—the result of foul air, excessive heat, bad diet, and the general neglect of hygienic rules. It s, we hope, practically banished from this country. This lisease is liable to be confounded with the scarlatinoid rash lescribed further on.

Hidrosis or hidrotid puerperal fever is the name given by Blundell to indicate a highly dangerous disease, of which the nost prominent symptom is profuse and distressing perspiraion. It is not common; and cases present great differences of intensity, from a mild form to extreme severity ending in leath. Ramsbotham describes it with care. He says, 'It reaks out within four or five days after labour, and is always ishered in by rigor. Universal diaphoresis breaks out. This orings no relief, but, on the contrary, a feeling of abject depresion; the pulse rises; thirst is distressing. The characteristic ign is the peculiar, unpleasant odour from the skin; it most esembles the smell of newly-turned earth. The breath is faint and sickly. The milk and lochia are commonly arrested. Diarrhea attends. The mental characteristic is irritability. Pain, even on pressure, is not marked. In bad cases, vomiting, vith hiccough, obstinate diarrhea, and quick respiration with ollapse precede death.

Ramsbotham thought it contagious. In all the cases he aw there had been serious hæmorrhage. In some cases he ound evidence of metritis, pus in the inner coat of the uterine eins; but in others no tissue-changes were detected. Of reatment Ramsbotham speaks sadly. He advised tonics, as ark, the mineral acids, and good diet. He differentiates

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hidrosis from miliary fever; but it is probable that both diseases arise under similar bad sanitary influences. It is one of the puerperal fevers that ought to be stamped out. Both point to the peculiar puerperal constitution, and illustrate the morbific reactions of puerperal blood and autogenetic and heterogenetic poisons.

The Zymotics in Puerperæ.

In the chapter on the Diseases of the Gravida the relations of the zymotics have been to some extent discussed. We have seen how scarlatina and its congeners may attack the gravida, how they affect the woman and the fœtus in utero.

We have now to add a short sketch of the relations to puerpery. These are the most striking examples of heterogenetic fevers. Beginning with scarlatina, we recall the facthat the infection may be taken before labour or during labour And it is extremely important to determine if possible when i began. For example, if the poison was taken in before labour, the probability is that it was not communicated by the doctor; if, on the other hand, the infection dates from labour it might have been communicated by him or the nurse. We have known an action to be brought against the doctor fo communicating scarlatina. It fortunately happened that the infection was clearly traced to a source acting before labour It might be supposed that the date of infection might be settled by the stage of incubation. But this method, although important, can hardly be applied with sufficient precision Some hours, a day or more, may elapse before the first distinc outbreak is observed.

In a valuable collection of cases, Dr. Braxton Hicks ('Obst Trans.' 1871), having grouped eighty-nine cases of purpera diseases according to the probable causes, found that in thirty seven the poison was almost certainly scarlatinal. As to incubation, Hicks observed that, although the woman may have been exposed continuously for months before labour, still the disease does not generally manifest itself till the third, fourth or fifth day after labour. Does the poison lie dormant until labour, when the arterial tension is lowered, and active absorption brings a rush of effete matter into the blood? This speculation is plausible at least.

The peculiar susceptibility of puerperæ to the invasion of carlatina is shown by the following fact. A doctor who has been in contact with a case of scarlatina may visit in the ourse of the next day or two twenty or thirty patients, and it probably only the lying-in woman who takes the disease.

It is sometimes said that scarlatina in a puerpera is carlatina and nothing more. We have elsewhere pointed out he fallacy of this apophthegm. There is something more, nd that is the puerperal constitution. This supplies a special ulture-ground—to use a term drawn from the modern doctrine of germs—which modifies the scarlatinal poison, and this in uch a manner as to disguise or mask it. Thus, the rash may ot be observed—at least, not in its usual characteristic manner. IcClintock notes that in several cases the eruption was very are in showing itself. Sore throat is probably rarely wanting ltogether; but McClintock says the affection of the throat vas comparatively slight in all the cases; he thinks this exempion is a remarkable feature. Braxton Hicks also found the ore throat slight in all cases. He adds-and we have made he same observation—that the influence of scarlatina may be hown without the rash or sore throat; but its scarlatinal rigin may not be indicated by the other usual characters. Flandular enlargements are not constant. Albuminuria is kely to be present; but albuminuria may be due to simple uerperal causes; and unless the urine be drawn by catheter, ven this condition may not be detected. Before the stage of esquamation is reached the patient may have succumbed.

It is worthy of consideration whether the scarlatinal poison, orking in disordered puerperal blood, may not only be itself to diffied, so that some of its ordinary characteristic phenomena may be changed, and that also some new kind of poison, a enomous tertium quid, may be produced. We may see in the clinical history of scarlatina in a puerpera a counterpart of that we see in the history of vaccination. In healthy subjects, accination runs a healthy course; but in some unhealthy blood-onditions the zymotic germs run riot, producing the most isastrous consequences, as erysipelas, diffuse cellulitis, and ther disorders. So in some healthy puerperæ the scarlatinal oisen runs a simple course, all the special phenomena appearing in due order; whilst in other puerperæ the same poison,

acting on bad blood, may develop inflammation and suppuration in various parts of the body.

One modifying condition, that may lessen the severity of the disease, is that the subject has had scarlatina before. This probability must be taken into account when discussing the reciprocal influence of scarlatina and puerpery. But the disease may run a fatal course notwithstanding. Whenever there is an epidemic of scarlatina, puerperæ suffer in larger proportion.

As these cases have occurred in simple labour, those who insist upon the traumatic nature of puerperal fevers must attach undue importance to traumatism.

Hicks found these diseases more common in new houses. This is the case also with other zymotics.

If we can prevent scarlet fever only, we shall have diminished the number of puerperal fever cases by at least half; and if attention is paid to clearing the uterus of its offensive contents, we shall avert a considerable number more.

The severity of scarlatina in puerpera. Ramsbotham a one time declared that this complication was nearly alway fatal; but at a later period, having seen several cases recover he came to look upon it as less serious. We have seen a fair number of recoveries; but, as a general fact, the complication is more serious than when scarlatina occurs in non-puerpera women. The patient may die before any tissue changes of an inflammatory or suppurative character have been developed. But if she survives some days, and the case does not end in defervescence and cure, the most grave alterations—as peritonitis synovitis, cellulitis, carditis, pueumouia, pleurisy, ophthalmic proceeding to destruction of the eye-ball—may eusue.

McClintock (1866) found in the Dublin Lying-in Hospita a mortality of ten out of thirty-four cases. He observed that the earlier the invasion the greater is the danger.

When the disease runs a favourable course the ordinary functions of puerpery are not interrupted. The milk and lochia continue.

The arguments stated in respect to scarlatina apply to the other zymotics.

One common property they possess is that from which their generic name is derived. The zymotic poisons have active self-reproductive, and infective energies; hence one infection of

dose is enough. This constitutes a broad distinction between the zymotics and the autogenetic toxemiæ. These latter are not reproductive.

Treatment. Bark, hydrochloric acid with chlorate of potash, stimulants and good nutriment, with frequent warm ablutions, constitute the treatment we have found most efficient.

We have seen cases of scarlatinoid rash breaking out in puerperæ, that seemed to be analogous to the similar eruptions observed in surgical patients by Paget and others. It is obviously difficult to differentiate them from scarlatina in the lighter forms, and from erysipelas. Hervieux, in a discussion on this subject, said that he had seen twenty cases at the Maternité; all recovered; in some the eruption was very vivid. There was usually intense fever; the eruption appeared first on the fore-part of the trunk, spread to the thighs, then to the upper part of the trunk, did not attack the face, and was not attended by a miliary eruption as is so frequently the case with scarlatina.

Erysipelas. The complication with erysipelas has often been noted, so that some physicians of limited experience in obstetrics have imagined that they discovered in erysipelas the essential cause of puerperal fever. They have even declared that puerperal fever is erysipelas. Gull ('Med. Gazette,' 1849) said: 'There is a close alliance between erysipelas and puerperal fever.' He examined three cases anatomically, and found in all, pus in the veins—not in the veins or sinuses at the seat of the placenta; these were filled with sound, healthy coagulabut in all three the veins about the neck had suppurated. He likens this to the origin of erysipelas in surgical patients. This escape of the body of the uterus and the seizure of the surrounding structures has been noted by Hulme and others. It is especially apt to occur in hospitals. But we have seen it amongst the patients of the Royal Maternity Charity who are delivered at their own homes. In one case, erysipelas appeared the day after labour on the face; both cheeks were distended on the sixth day; a large bleb came on the left cheek; there was great depression, high fever, but the milk was not stopped. She had bark and ammonia, and recovered.

^{&#}x27; 'De certaines éruptions dites miliaires ou scarlatiniformes des femmes en couches, ou de la scarlatinoïde puerpérale, 1862.' L'Union Méd. 1863.

In another case, that of a woman in her thirteenth labour, with twins, both born alive, shivering appeared on the fourth day; on the fifth day erysipelas broke out on the face, the lochia and milk were checked; on the eleventh day the erysipelas had spread, shivering and diarrhea set in; on the thirteenth day she took perchloride of iron, and recovered.

It is not always possible to trace how the infection was caught. But we do not believe it arises spontaneously. Thus two women living two miles apart had fatal fever in puerpery; they were attended by different men, both of whom had thirty or forty hours before examined the puerperal sore of a phlegmonous erysipelas. Storrs had a series of eight cases of fever after treating a gangrenous erysipelas.

Erysipelas will perhaps account for more epidemics of puerperal fever than any other external poison, scarlatina not excepted. The epidemics described by Armstrong, Hey, and many others ran their course pari passu with erysipelas in the town.

Lever adduces remarkable instances of erysipelas causing puerperal fever, and of the puerperal affection reproducing erysipelas in infants and nurses.

Dr. Gordon notes that the two epidemics of erysipelas and puerperal fever began in Aberdeen at the same time, and afterwards kept pace together; they both arrived at their acme together, and they both ceased at the same time. He says further that the epidemics he witnessed in Durham and Northumberland closely resembled the epidemics of Aberdeen and Leeds. Hey records that in Leeds erysipelas was epidemic at the same time as puerperal fever. Joseph Clarke says the epidemic which visited Dublin in 1767 was like that described in London by Hulme.

Diphtheria in puerperæ is not, in our experience, frequent in home-practice. We have seen a few cases in which diphtheritic exudations appeared on the perinæal wound and in the vagina, attended by severe fever. Hicks notes seven cases. 'It may produce,' he says, 'only the symptoms peculiar to itself, or it may be accompanied by secondary local and general lesions.' Diphtheria occupies a more important place in the hospital epidemics of Germany.

Typhoid. We have seen several cases of puerperæ attacked by typhoid. The characteristic rash appeared.

Variola. For information upon this complication in puerperæ the reader is referred to the chapter on Diseases of

Gestation, Vol. I.

In one case, read by Robert Barnes to the British Medical Association at Dublin, 1867, the rash assumed a purpuric appearance. In that communication the proposition was enunciated that any one of the zymotic poisons, having invaded a pregnant or puerperal woman, has its usual action modified by the special state of the blood attending her condition. This is so true that in many cases the specific zymotic disease is not easily recognised by its peculiar features, and the symptoms resulting from the combination are merged in a state that passes for puerperal fever. In the case of small-pox, it is true, the characteristic eruption commonly shows itself. But the variolous poison, received into blood already altered by the puerperal state, may be the oceasion of such reactions in the blood as to produce symptoms widely differing from ordinary small-pox. This purpuric appearance has been noted in other cases of variola in puerperæ.

Modes of Infection.

All the recognised modes of infection ascertained to operate in spreading animal poisons may be traced in the case of the puerpera. She is liable to invasion by the typical zymotics; she is open to their attack by similar routes, and by a special route in addition—that is, by direct inoculation on the parturient canal. It is by this route more especially that the poisons, other than zymotic, effect an entrance. To enumerate the entrances: All the organs of absorption may take in poison, and carry it into the circulation. Thus, the intestinal eanal, the lungs, the skin, the connective tissue may let in the enemy. In the puerpera there is also the parturient canal.

No one doubts that the connective tissue and the mueous membrane of the intestinal eanal may give entry to animal, as to other poisons. The parturient eanal, whether intact or wounded, is a frequent route. But some, including Schroeder, doubt whether the poison can effect an entry by the lungs. Clinical facts lend unanswerable force to the judgment of Tarnier,

who says that 'the lungs, by their extent, their activity, present favourable conditions for absorption, and that it is often by this route that empoisonment takes place.'

The carriers of the poison. The zymotics may be carried in the air, water, and milk supplied to the patient. The air and water become contaminated by emanations and excretions from the subjects of variola, scarlatina, pertussis, rubeola, typhoid, erysipelas, cholera. The poisons of these diseases may also be conveyed by linen, sponges, or other articles contaminated in like manner. Sewage or fæcal matter may contaminate both air and water. Cases under our observation have carried the conviction that scarlatina and puerperal fever have been communicated by sewage gases. We may conclude that the scarlatina-poison, microbe or other, is cultivated or preserved in the sewage.

Then there is direct inoculation by touch. The obstetrist or nurse, whose hands are tainted, may carry the poison directly into the vagina or uterus, and there it is taken up either through the intact mucous membrane or through a wound. In the latter case the poison is deposited in the connective tissue, an active absorbent and transmitter. In our experience a wound is not necessary. We do not think there is any fallacy in the clinical observations we have made to vitiate the conclusion that the poison has been taken up in consequence of examinations made during the first stage of labour, that is, before any wound was made. Indeed, in a large proportion of cases no entry of the hand, no vaginal examination is made after the head, which makes the wounds, has passed.

It is by touch generally, if not exclusively, that the necrotic or cadaveric poison is communicated. Our knowledge of the nature of the cadaveric poison has been rendered more precise of late years. We do not know if it has been actually isolated and defined. It is enough for our present purpose to know that there is developed in the body shortly after death a poison of peculiar virulence, and capable of transmission by inoculation. The dissecting-room supplies, unhappily, too many illustrations of this.

Ramsbotham says: 'I am quite convinced that the contagious properties of puerperal diseases are rendered even more penetrating and subtle after death; and that articles of

clothing impregnated with the effluvium arising from opening the body of a woman who has died of a contagious puerperal malady are the surest instruments of its further propagation.' One of the most instructive lessons is that conveyed in the

One of the most instructive lessons is that conveyed in the history of the Vienna Lying-in Hospital, in 1846-47, under Semmelweiss. It is related by him and by Dr. Routh, who observed the facts. It was established that puerperal fever was communicated directly by inoculation from the hands of medical students, who came from the dead-house and from the coroner's court, and, satisfying themselves with simply washing their hands in a little water, made examinations of women about to be delivered. One point Routh vouches was clearly made out—namely, that the disease was not contagious from one person to another, except the discharges were in some manner communicated. Many of the nurses and midwives had children, but not one of these women caught the disease. In the division where the labours were attended by women who had nothing to do with dead bodies the disease did not exist, or the cases were few and far between. After the students washed in a solution of chloride of lime, the mortality in their division fell to the same ratio as in the midwives' division.

It must, however, be borne in mind that severe endemics of puerperal fever have raged in the midwives' division at other times.

But the poison carried from the post-mortem or dissecting-room is not necessarily the cadaveric poison. If the subject of autopsy have died of scarlatina, for example, the scarlatinal poison will be conveyed. Thus, to record one example: A friend performed the autopsy of a woman who had died of scarlatina; two patients whom he delivered soon after both suffered severely from fever, and scarlatina broke out in their households.

The performance of manual obstetric operations has often been followed by puerperal fever. Thus Dr. Hardy, of Paris ('Arch. gén. de Médecine,' 1861), said that in the preceding year every case in which turning was practised in the Maternity of St. Louis was followed by fatal metro-peritonitis. And in contrast to this is the immunity of so-called street-labours—that is, of women who were delivered on their way to the hospital. Spaeth, in his report of the epidemic in the Vienna

Lying-in Hospital for 1861-62, says that of 90 women delivered in the street and brought to hospital only one took fever, although they were placed between sick puerperæ. That is to say, when puerperal fever rages in a hospital, it is better for an unfortunate woman to be delivered without help in the streets, than according to art under the direction of science.

A mode of convection, a sad example of which came under our observation, deserves to be noted. A lady, living in an isolated house in the country under the best hygienic conditions, was seized with fever five or six days after an easy labour, no internal examination having been made. The doctor, who had seen no zymotic case for months, and spent many hours a day in the saddle, could hardly have been the poisoncarrier. Robert Barnes saw her when she was in extremis. The nature of the fever was not revealed by any pathognomic sign; but there was no evidence of metro-peritonitis. After her death, her sister, who had been nursing her, went home to London. Soon after, two of this sister's children sickened with scarlatina. It was then discovered that the nurse, without informing the doctor, had brought an infant from the village three miles distant to the lady to draw her breasts. There was scarlatina in the house from which the child was brought. The chain of evidence was complete.

Fever may be propagated to the woman before or after labour by the medium of the husband or other person coming into close relation, the person serving simply as a carrier. We saw a case of puerperal fever in a London suburb, the conditions of which were subjected to careful investigation. The conclusion arrived at by three physicians was that the infection was communicated by the husband, who had been working in the garden, which had been made up of foul rubbish. He himself had felt unwell, but exhibited no characteristic symptoms. In this case the poison may have been typhoid or scarlatina, but this could not be determined.

Poisonous air may enter by the skin, by a mucous membrane, or by the gaping mouths of veins. It may be inhaled or swallowed. Inhalation is the more frequent. But it may get into the uterus. This it may do in the following ways:— Air may run up alongside the hand and arm during version or other operations. After the child is born, the woman lying

on her side, the relaxed uterus, not supported by the flaccid abdominal walls, bags down, the perinæum is then retracted by the hand in order to remove the placenta, and air rushes in. Sometimes the mere prone position, the vulva gaping, is enough. Alternate contraction and relaxation of the uterus may pump in air.

Air may also be forced into the uterus during intra-uterine

injections of fluids.

Air, having effected an entry into the uterus, may work mischief in several ways. The air admitted may be charged with poisou from without, and may be the direct source of poisoning the system. It may enter the open mouths of the vessels on the placental seat. It may, by a process of endosmosis, pass through the tissues of the uterus, or be taken up by the connective tissue exposed by a wound of the mucous membrane. This is heterogenetic poisoning.

The air admitted may be in itself innocuous; but, being retained in the uterus, it may favour decomposition of loose blood-clots and placental-fragments, and also of thrombi in the uteriue sinuses. This is autogenetic poisoning.

uteriue sinuses. This is autogenetic poisoning.

Physometra has been described in a preceding section

(see p. 453).

The Question of Epidemic Puerperal Fever.

That fevers may rage amongst puerperæ, just as the ordinary zymotics, scarlatina, variola, typhoid, are observed to spread in ordinary communities, is notorious. But it does not follow that the fevers spreading epidemically amongst puerperæ belong to the same order as the zymotics. The spread of fever amongst puerperæ may be explained in several ways: 1. The fever is simply variola, scarlatina, typhoid, erysipelas, or some true zymotic, seizing upon puerperæ as it does upon other members of the community. When this is the case we may expect to find concurrently, fever amongst puerperæ and the general community. 2. Fever attacks puerperæ in hospitals to which lying-in wards are attached, especially if the medical and nursing services are in common. In such cases the disease is of the services are in common. In such cases the disease is of the same nature; it begins with the medical or surgical patients, and is propagated to the puerperæ, in whom it finds a congenial soil. Erysipelas is the most common disease. 3. The fever

begins and ends amongst the inmates of a lying-in hospital. In such a case the disease may be an ordinary zymotic, or it may be a poison of non-zymotic type, propagated by the medium of touch or inoculation, or as the result of nosocomial malaria.

In hospitals it has often been observed that the fever was caught before labour. Thus, Kchrer ('Monatsschr. f. Geburtsk.' 1861) says in his hospital at Giessen the infection was taken before labour. The course observed was as follows:-During labour the pains were disturbed, ineffective, painful, spastic, so that medicines or forceps were often necessary. Some hours after labour, or ou the first or second day, a shivering, of variable intensity, set in, followed by dry heat of skin, quickened pulse, acute pains in various parts of the abdomen, and quick collapse. The eyes were sunken, with a peculiar deadly appearance; tongue dry; breathing oppressed; constipation, or more often diarrhea. Under rapid prostration, death followed in two or three days. On autopsy, more or less exudation was found in the abdomen of serous, sero-purulent nature, sometimes purulent, with many flocculi. The intestines were much distended with foul-smelling gas; the uterus was much distended, lax, contained dark, putrefying blood; in the veins were stellate, pus-like masses; the spleen was mostly soft and swollen. The exudations in the abdomen were not attended by inflammation in the parenchyma of the uterus or of the peritoneum; the latter especially was not reddened, injected, or altered.

How puerperal fever is propagated in hospitals. Can a fever be developed under the simple conditions of overcrowding? There is strong evidence to show that it may. Lusk observed that in his hospital febrile outbreaks were quickly arrested by closing tainted wards and transferring the inmates. Edward Rigby checked fever in the General Lying-in Hospital by establishing efficient ventilation.

An argument has been held that the special epidemic character of puerperal fever is proved by the simultaneous prevalence of fever in hospitals and in the surrounding population. There is an obvious fallacy in this. Of course, scarlatina or other zymotic may arise in a town and attack the puerperae outside and inside the hospitals, or it may be limited to one or other class. Hirsch says that, in 216 epidemics collected by him, only 12 spread over wide tracts of country; 129 were

limited to isolated institutions or parts of institutions; 41 extended from hospitals to the town, but in 21 of these only isolated cases occurred in the towns; 34 affected exclusively the private dwellings of a single locality. Hirsch says the contemporaneous prevalence of typhus or scarlatina is purely accidental.

We have analysed a large number of reports of epidemics of puerperal fever as to this point, and arrived at the same conclusion as Hirsch. But this kind of negation is not enough. The prevalence of a zymotic, as scarlatina, in a town, its lying-in hospitals remaining free, and vice versâ, may be explained simply by supposing that the women in the town and in the hospitals have been attended in labour by distinct doctors and nurses, and that no dangerous communication by other means between the two classes of puerperæ existed. On the other hand, instances abound in which fever was propagated from hospital to town, and vice versâ, where intercommunication existed. One infective case, either directly imported into the hospital, or started by doctor, nurse, or visitor, or linen, or other means not always traceable, is enough to create an epidemic.

The analogous observations between the spread of fevers amongst puerperæ in lying-in hospitals, and the spread of diseases commonly associated with the idea of hospital malaria, and other special hospital influences, have been much insisted upon in support of the theory that the puerperal fevers are of the same nature as the surgical fevers in general hospitals. The puerpera is likened to a surgical patient. The argument is further enforced by the histories of epidemics in hospitals which admitted both surgical cases and lying-in women. The puerperæ were attacked by diseases, as erysipelas, hospital gangrene, identical with those which affected the patients in the surgical wards. The facts are true; but they do not quite justify the theory constructed upon them, as will be pointed out further on.

Hospital miasm. In discussing the question of malaria in hospitals as a cause of fever in puerperæ as well as in surgical patients, it is important to take into account the analyses made of the air and deposits from it in hospital wards. Thus Eiselt discovered pus-cells in the air of an ophthalmic ward. Epithelium-cells are found in all ill-ventilated rooms. Chalvet found, in dust collected in the wards of St. Louis, 36 and 46 per

eent. of organic matter; it eonsisted in great measure of epithelium-cells; when burnt it gave out an odour of horn; when moistened and allowed to decompose it gave out a feetid, putrid smell. He found it collected in the bed-curtains and on the walls and windows. Parkes made similar observations in the air of various barracks and hospitals. In all tainted atmospheres of this kind, it appears that the germs of infusoria abound to a much greater extent than in pure air. Chalvet found that linen returned from the wash was still tainted with organic detritus. We know that vaccine matter may be preserved on linen threads. Parkes found that there was some relation between the proportion of carbonic acid in the air and the quantity of organic matter. The smell of organic matter is generally very perceptible when the carbonic acid reaches ·7 per 1,000, and is very strong when it amounts to 1 per 1,000.

A putrid emanation acting for a very short time suffices to turn milk, or to set up putrefaction in meat. According to Pasteur, different kinds of chemical change are brought about

by different germs.

Samuelson ('Quarterly Journ. of Se.' 1864) made observations of like kind. Examining dust from window-paues in distilled water, he found cereomonas fusiformis, amæbæ, and other organisms. The atmosphere was the medium through which the germs or spores were conveyed into the distilled water. He always found that the more freely the water was exposed to the air, and the warmer the temperature, the more abundant and diversified were the living types, and the more rapid their development.

Some of the deductions from these facts are obvious. In the face of them and of clinical observation in hospitals, it is absurd to doubt the reality of aërial convection of disease. It has been observed that the greatest care in washing the hands may fail; and fevers have been started where no direct inoculation by hands was possible. The virus may be caught, condensed, in the woolleu clothes, whence it is given off in aërial form and inspired by the patient, or comes in contact with the traumatic surface of the perinæum. This is confirmed by the histories of fevers following in the track of nurses.

Charles White says that 'the effluvia (from puerperæ suffering from absorption of putrid stuff from the uterus)

help to make the air in the bed and in the room more putrid; this air in every act of inspiration is taken into the lungs, and is then again received into the circulation.'

Is it not also possible that a doctor or nurse who has been in close attendance on women suffering from puerperal fever may become, as it were, saturated with the poison, and exhale it by the breath, to the danger of other puerperæ with whom they may come in contact? However this may be, we have had too many sad occasions to see the wives of doctors struck down by puerperal fever. We feel very certain that puerperal fever attacks them in larger proportion than it does other women in a corresponding social sphere.

There are many examples of the propagation of the poison which has produced fever in a puerpera to infants, nurses, and others coming into close relation with the puerpera. We will cite a few examples only. Hugenberger relates that 'during the raging of puerperal fever in the Midwives' Hospital at St. Petersburg, the hospital-poison attacked women labouring under uterine disease, servants, pupils, and midwives. a woman with chronic uterine catarrh died under plain symptoms of essential puerperal fever, and dissection showed exquisite suppurative metro-peritonitis. In 1856 a female attendant in the post-mortem room died of malignant peritonitis. In 1858 two intern pupils were seized with typhus and peritonitic symptoms, and died. In 1858-9 midwives had protracted erysipelas of the legs. One of these had, at the beginning of her illness, attended a lady in town, and in all probability occasioned in her fatal pyæmia.'

In appreciating cases of non-puerperal women taking disease from puerperæ, we must remember the analogy we have so often insisted upon between menstruation and labour. We think that on no account should a woman do duty in the post-mortem room.

Influence of puerperal fever upon new-born infants. Hugenberger relates that during 1846, 1848, 1856, 1859, pregnant women who stayed long in hospital brought forth an increased number of dead and putrid children as compared with the average of 15 years. The mean of 15 years and 8,210 children was 498, or 6 per cent., putrid children; but in the spring of 1846 it was 10 per cent.; in autumn, 1848, it was 8 per cent.;

¹ Puerperal-Fieber im St. Petersburger Hebammen-Institute, 1862.

in winter and spring, 1856, 12 per cent.; and in winter, 1859, 9 per cent. In 1849, 1852, 1854, the proportion was the normal one, and there was the least intensity of puerperal-process. 1846, 1848, 1856, 1859 were years of greatest fever-mortality. The history of mortality amongst live-born children is also

The history of mortality amongst live-born children is also instructive. In 1846, during the height of the fever, cases of sudden death of new-born children were frequent, under symptoms of eclampsia and trismus. The children that fell were mostly sound, well-nourished. In this year, also, acute atrophy with jaundice, erratic and phlegmonous erysipelas, and sclerema were not uncommon. In 1856, during January and February alone, 32 cases of malignant ophthalmia appeared; frequent pyæmic exanthemata, gangrenous erysipelas, umbilical phlebitis, and acute exsudative peritonitis reigned during the prevalent fevers of the mothers.

Disease may pass from puerperæ to men. In the 'Rivista Clinica di Bologna,' 1880, in an account of an epidemic of puerperal fever which raged in Pollcnza in 1876, it is stated that a man had intercourse with his wife, who had been recently delivered and had fever with rigors. The man had fever and rigors the same evening, and pain in the groin. Soon erysipelas set in on the penis, spreading to the thigh. On the second day the temperature was 40° C.; gangrene appeared on the scrotum, multiple abscesses, hydrothorax followed, and the man died on the seventeenth day.

In some cases it is certain that the disease caught by a man from a puerpera was scarlatina, typhoid, or some ordinary zymotic. A former colleague, Dr. Manson, thus took typhoid from attending a woman suffering from puerperal fever, and died. But in the Italian case the poison would seem to have been directly inoculated on the penis, and the history of the case differs widely from the course of an ordinary zymotic. And it is probable that in cases like Dr. Manson's the typhoid poison is modified or intensified by working in puerperal blood, and so acquiring special virulence. As Arthur Farre put it: 'Nor is it quite certain that zymotic or other inoculating poison may not add a new form of sepsis to that which is already in the blood.'

Dr. Storr¹ found that in an epidemic of puerperal fever many of the husbands contracted peritonitis.

¹ Trans. of Prov. Med. Association.

Puerperal mortality in workhouses. It is instructive to contrast the dangers of lying-in women in hospitals with those in workhouses. Mouat (Trans. of Intern. Congress, 1881) showed that the mortality was less than in the special lying-in hospitals; that the death-rate from metria alone was less than in the entire population. This comparative immunity is no doubt due to the simpler and more secluded conditions under which women are placed in the workhouses.

Pathological Anatomy. It would be to affect a refinement and precision of knowledge quite beyond our grasp, to pretend to give a systematic description of the lesions encountered in puerperal fevers, assigning definite lesions to definite forms of fever, and to associate with them distinctive diagnostic signs.

The best we can do at present is to recognise the fact that most of the changes observed in the post-mortem room have been met with in connection with almost every variety of puerperal fever. In some cases, indeed, phlebitis is the most predominant phenomenon, and this is recognised during life; in others, peritonitis is the main condition discovered, and this also may have been recognised during life. But we cannot say that there are any tissue-changes that specially characterise the fever due to scarlatina, or that can differentiate a case of autogenetic septicæmia from one of heterogenetic origin.

We can only formulate the following propositions:-

1. In one group of cases of fever arising from the most varied causes, terminating fatally, we may discover no structural or organic changes. The subjects have died of general toxemia.

2. In another group of cases, arising from the same causes as those of the first group, the most extensive tissue and organic changes will be found.

3. In some cases these changes have taken place rapidly; in others they have been developed at a later period after labour.

The nearest approach to precise attribution of local changes to a particular form of puerperal intoxication is found in the history of phlegmasia dolens and thrombosis and embolia. In these cases we have strong evidence that the disease is of local autogenetic origin. The like proposition may be affirmed of pelvic cellulitis in the simpler forms.

Beyond these conditions, localisation can hardly be affirmed.

The fact that the most varied pathological conditions may follow upon fevers of diverse origin may receive some light, from the peculiar blood conditions of puerpery which underlie all the forms of fever, imparting to all a common character, and binding them together in one broad pathological group.

The morbid appearances found after death present remarkable constancy. If we were justified in interpreting this constancy as evidence of oneness of the disease, we might hope to solve the question as to the essentiality of puerperal fever. But the study of causes has always been more complex than the study of effects. We may, however, see in this constancy of pathological effects, proof that there is one underlying condition that controls all the morbific factors, imparting to the disease, once started, whatever its origin, a peculiar character. That character is the puerperal.

Premising these general propositious, we may attempt a sketch of the pathological appearances most commonly found. For convenience we may take in order the changes found in the several tissues and organs. Those found in phlegmasia dolens and in thrombosis and embolia have been described in the section on those affections.

No organ or tissue in the body is exempt; but in many cases there is greater concentration of mischief in particular parts. The uterus, being generally the fons et origo mali, may be taken first. This will lead us to the consideration of metritis. Is there a pure and simple metritis? Can we find or imagine a case in which the proper structure of the uterus is alone inflamed? It seems difficult to imagine a case in which the inflammation does not begin with the uterine vessels, which have to bear the first brunt of the septic or offending matters lying in the uterine cavity. The term 'metritis,' then, should properly embrace inflammation of all the structures of which the uterus is constituted. In this way we shall get the concrete idea of inflammation of the veins or sinuses, of the lymphatics aud muscular tissue of the uterus. In the middle cases, in which either the poison is less virulent or its actiou limited in time, and the resisting quality of the blood is greater, the mischief is chiefly expended upou the vessels, the contiguous muscular tissue being but slightly affected. Such a case would be recognised in life as metritis, or as phlegmasia dolens; or,

the vessels and uterus proper escaping serious complication, the inflammation would seize upon the pelvic connective tissue or peritoneum. Cases of this kind often end favourably; and there is little opportunity for observation by dissection.

But in other cases, in which the poison is more virulent or more prolonged in its action, and the patient's constitution less capable of resistance, not only are the phlegmasia and lymphangitis more intense, but the whole uterus, and commonly its adnexa, are involved. Then we get metro-lymphangitis and phlegmasia. This is but too apt to pass into suppuration—the suppurative metritis of Cruveilhier, so well described and figured by him. It is especially apt to occur in lying-in hospitals, where the individual morbid proclivities are acted upon by the accumulation and intensification of morbific influences. In these cases the uterus is found much enlarged; the muscular tissue is red (dark red), softened, friable; abscesses are diffused in the walls; the veins and lymphatics are tracked by irregular swellings distended by pus; the lymphatic glands are swollen, inflamed, and contain pus. By referring to fig. 54, Vol. I., which represents the gravid uterus turned down so as to show the immense network of lymphatics on its surface, and the associated glands in the lumbar and dorsal region; and imagining the whole system to be involved in inflammation and suppuration, we shall have a pretty accurate idea of the seat and extent of the affection.

When the disease is taking this course, the general symptoms are much more severe than in the first order of cases; the pain may be less, but the fever is more intense. The pulse is commonly over 130, it may run to 150 or more; the temperature rises to 104° or 105°; rigors are repeated; there is rapid and marked prostration; the mental faculties are dulled; the tongue is dry; bilious vomiting, perhaps diarrhæa, sets in. Delirium, coma supervene. The respiration becomes short and difficult. The lochia are generally, but not always, suppressed. Death follows in a few days.

A more serious form still is the gangrenous metritis, also and more especially a hospital affection. The gangrene commonly extends to the vagina and vulva. It must not be confounded with the necrosis of tissue caused by severe protracted labour, and direct crushing, or other injury of the

parturient canal. In the gangrenc of puerperal fever, the labour may have been easy. The tissue changes are the result of general empoisonment, telling first upon the parturient organs, although undoubtedly traumatism may be an important factor. These cases are almost necessarily fatal. But after death it is surprising to find how extensive the loss of tissue sometimes is; the cervix and vagina have literally sloughed or melted away, exposing the promontory of the sacrum.

In the cases of metritis and metro-peritonitis, suppurative inflammation of the Fallopian tubes is frequent. They are filled to distention with pus, making them sinuous with irregular dilatation; attending this we see inflammation and suppuration of the ovary, and irritation of the adjacent peritoneum, or acute pelvi-peritonitis with adhesions, binding the fimbriated end of the tube to the ovary, and occasionally leaving gaps through which pus exudes. These slender purulent adhesions are easily broken down during the examination.

Internal puerperal metritis, whether it arise soon after labour or several weeks later, is never simple. It spreads to the parenchyma, sinuses, lymphatics, and often to the peritoneum, tubes, and ovaries. Since all these structures have recently been the seat of intense physiological activity, suddenly arrested by a traumatic process, and the blood carries an excess of fibrin and is otherwise modified, they are peculiarly susceptible to inflammation. The putridity of the contents of the uterus, phlebitis, lymphangitis, the state of the blood and lymph, which carry septic matter and infectious germs, are the causes of the uterine inflammation, so often quickly followed by multiple metastatic abscesses, general peritonitis, and death. Autopsy of recently delivered women who have died of metroperitonitis reveals the uterus uncontracted, with flaccid walls, permeated with fluids, pus, or a fibrino-puriform coagulation, more or less filling the venous sinuses. The mucous surface of the uterus exhibits a mulberry colour and a pulpy softening of the decidua, or a sanious puriform liquid which has soaked into the softened mucous membrane. At the level of the placental site is seen a quasi-vegetating surface, formed by the projecting cotyledons of the mucous membrane. On the projecting parts small fibrinous clots are often seen. The whole placental disc is soft, pulpy, infiltrated with sanious blood

mixed with a feetid puriform fluid. Often all this part is gangrenous, blackish-brown, and if a stream of water be made to drop on it, shreds of the mucous membrane are detached. At other times there is found on this surface a greyish false membrane, which can be detached in shreds, exposing the mucous membrane tinged reddish-brown. This diphtheritic or gangrenous false membrane sometimes extends over the entire inner surface of the uterus. When the liquid obtained by scraping the surface is examined by the microscope, a great number of lymphatic cellules are found. In the deeper layers of the mucous membrane infiltrated with serosity, scraping collects a little liquid which contains lymphatic cells, large cells of connective tissue, swollen and granular-fatty. The neck of the uterus is softened, violet-red, pulpy, also often covered with the same grey pseudo-membranous mortification as that observed in the body of the uterus; under this membrane the tissue is deeply congested. A similar gangrenous lesion often exists in patches on the vaginal mucous membrane and on the vulva.

The cavity of the venous sinuses is free, or contains, as already mentioned, a puriform liquid, or fibrin coagulated, or pulpy and softened, half liquid, mixed with lymphatic cells and endothelial cells, swollen and granular. The walls of these sinuses in the uterine muscular tissue present evident marks of endo- and periphlebitis. The large veins are often filled with pus or fibrin, and the connective tissue of the broad ligaments always contains more or less pus, so that when sections are made of the broad ligaments in a line with the uterus, one always falls upon one or several small purulent foci, situated either in the veins or connective tissue.

The superficial lymphatics of the uterus are sometimes filled with pus, and in all cases the uterine peritoneum is the seat of intense inflammation, with redness, vascularisation, formation of false membranes of fibrino-puriform character. The tubes and ovaries, as before described, are attacked in the same manner. Metastatic abscesses are frequently found in the lungs, liver, kidneys, and spleen.

In the metritis which arises some time after labour the phenomena are far less intense. The uterus has contracted, unless it contain large clots or pieces of placenta; the venous plexuses have had time to contract, and the greater part of the decidua has fallen. All the parts of the uterus and its adnexa are less vulnerable. Nevertheless the metritis is always more intense than when arising independently of gestation; it is often attended by perimetritis—that is, limited to the pelvis. There results a limited peritonitis circumscribed by false membranes containing a collection of pus. At other times there is formed a phlegmon of the cellular tissue of the iliac fossa.

We may add a fact not without interest. In one case of fatal metro-peritonitis which occurred in the Queen Adelaide's Lying-in Hospital—an institution now closed—we found the stomach had been perforated by post-mortem digestion by the gastric juice. The specimen was exhibited to the Pathological Society, and was cited by the late Mr. Grainger.

The most universal condition discovered after death is probably peritonitis. This was the prevailing condition in a century of epidemics analysed by Churchill—the true form of peritonitis without metritis. His theory was that the essential condition of puerperal fever was inflammation of the omentum.

The condition of the blood itself, so intimately related to the alterations of the tissues and to the effusions, demands more minute investigation. Hulme (1772) states that the blood taken away was generally sizy, with a quantity of yellow serum. He did not remember ever seeing the blood in a dissolved state. Since venesection has been virtually abandoned, the opportunities of examining blood in large samples are rare; but enough for microscopical and chemical examination might be obtained by puncture.

Symptomatology. It may be premised, as a general proposition, that in the stage of invasion and beginning of the fever no distinctive signs present themselves which enable us to predict the form of the disease or the precise nature of the morbific poison. History may give a clue as to its nature by informing us of the conditions to which the puerpera has been

exposed. But history is full of pitfalls.

When the poison has begun to work before labour, one effect is commonly seen in the disturbance of the process of labour. The labour is lingering from the irregularity and feebleness of the pains. The mental and other nervous reactions are dulled. And yet the poison may have provoked the onset of labour before it is due.

When the poison, zymotic or other, is taken in at the time of labour, the symptoms generally show themselves on the third or fourth day. It is about the same time that the symptoms appear in the autogenetic cases. Before the third day there can hardly be much septic stuff in the uterus, and the tide of absorption has not yet set in.

Classification of symptoms. In order to appreciate more clearly the significance of the symptoms, we have attempted to classify them.

1. There are first the signs of invasion. These are rigors, headache, backache, hysteria, depression, fainting, minor degrees of shock; then a rise of temperature to 101° or 103° F.; rise of pulse to 100, 110, 120; the pulse at first is often wavering or of irregular rhythm; the respirations rise to 25–30. Reflection will show that these symptoms individually and collectively indicate the infliction of an injury telling upon the nervous centres—that is, a form of shock. These are the symptoms which follow upon the ingestion of animal poisons. They are not always equally marked.

There is one sign, the gravis odor puerperii, sometimes noticed. But this is by no means constant, and is often present in a striking manner in healthy puerpery. It is associated with the lochia; the diapers used to the genitals are peculiarly nauseous, but the patient also breathes out, and exhales by the skin, the same characteristic odour. It is analogous to the bromo-menstruation described by Dr. Wiltshire.

- 2. Signs of reaction or of elimination follow. These are: tumultuous action of the heart, irregular pulse, vomiting, diarrhea, sweating, further rise of temperature and pulse, and greater frequency of respirations, 25–35 in the minute; the breathing is sometimes suspirious; often there is delirium, such as attends fever; the patient is easily recalled to ordinary perception when directly called upon, but, left to herself, she may be observed to wander more or less. The normal secretions, milk and lochia, are commonly partially or wholly suppressed; indeed, the entire glandular system is disordered.
- 3. Signs of general infection established. Rheumatic pains in the joints and limbs; sweating. In severe cases, diffuse cellulitis, inflammation of muscles, abscesses, ophthalmia, jaundice, pleurisy, peritonitis, pericarditis; inflammation and

suppuration in the joints; the pulse, temperature, and respira-

Of course all these symptoms are not always present in the connection and sequence set forth. But still they generally have the significance assigned to them. There is commonly some overlapping or recurrence of the first group of symptoms with those of the second group. Thus, if the case be one of autogenetic sepsis, as when septic stuff is taken up from the cavity of the uterus, there may be fresh attacks of rigor, headache, depression, syncope, complicating the signs of reaction or of elimination. When this is seen we have nearly sure evidence of renewed or continuous absorption of septic stuff. Each new absorption entails a repetition of the signs of invasion.

General infection is often marked by high fever alone, without the tissue alterations enumerated. But we insist upon the 'rheumatic pains,' as they are called, as an indication of the system being permeated by the circulating poison and acting upon all the tissues. We have known cases in which these pains were interpreted as acute rheumatism, and the subjects sent to a general hospital under this diagnosis.

Whenever diffuse, or peripheral, pains and stiffness are observed we should be on the alert for swelling, erythematous blush of the skin, and blebs or vesicles on the hands or fingers. These blebs generally show, at first, serum more or less limpid; but this soon becomes turbid. We have seen cases in which the depending part of the bleb was turbid and the upper part clear, as if pus-globules, separating, gravitated.

The significance of pain. A thing never omitted on visiting the puerpera is to feel the abdomen and hypogastrium. In this way pain is elicited if there is inflammation. Pain is a common, but not constant, attendant upon peritonitis. It may be said that pain is especially marked in the more simple and acute forms of peritonitis, and that in cases where peritonitis is secondary upon or complicated with general toxemia and metritis, the pain is less urgent. Looked at in this light, pain is a favourable sign. It is a source of comfort and hope to the patient to be able to tell her that pain is not the measure of danger. On the other hand, pain, simulating after-pains or uterine spasms or colics, should always arrest attention. It is often the first signal of danger.

Pain, acute, the centre of which is in one side of the pelvis, may indicate perimetritis or thrombosis. The pain along the course of the femoral vessels and in the popliteal space, aggravated by pressure, probably indicates thrombosis or phlegmasia dolens.

Pain in the joints, especially in the shoulders or knees, is often the first warning of septicæmic synovitis or arthritis. This pain is usually attended by stiffness and impaired mobility of the limb. Hence the importance of ascertaining if the puerpera can move her limbs easily.

The signs may further be classed as favourable and unfavourable. The prognosis is favourable when the pulse and temperature fall and become steady, the aspect improves, and when the tongue becomes clean and moist.

The prognosis is unfavourable when the temperature rises to 105° or more; if it falls rapidly; when the pulse runs to 140–160, is small; when the respirations run to 40 and are 'catching'; when the aspect is sunken, anxious, clayey or dusky, indicating septicæmic cachexia; when there is delirium, the mouth and tongue covered with sordes; when aphthæ and diphtheritic patches appear on traumatic surfaces and on the vagina. Another sign of ill omen is tympanites. It is an indication of lowered nervous force; it is due to paralysis of the muscular coat of the intestines. If this sign and the diarrhæa and vomiting persist, the prognosis must be grave.

The signs of imminent dissolution are a pulse feeble, not easily felt or counted, temperature abnormally high or below 98° F., rapid suspirious respirations, hiccough, delirium of muttering character, catching at the bed-clothes, subsultus tendinum, prostration in supine posture.

The special treatment, of the several forms of puerperal fever has been considered in connection with their clinical history. It will be useful, nevertheless, to pass in review the principles of treatment, prophylactic and therapeutic, which have a general application.

Prophylactic treatment. Antiseptic midwifery. There is some danger in dwelling overmuch upon so-called 'Antiseptic Midwifery.' The better and more comprehensive term is 'Prophylactic.' For the first part of this treatment we refer to the section on the care of the puerpera (p. 86). So far as

antiscptic appliances are concerned, they can strictly only be regarded as subsidiary means in the carrying out of the great principle that lies at the bottom of all good obstetric practice, namely, to screen the lying-in woman from those poisons and other noxious influences which threaten her from within and from without.

It is not, therefore, desirable to devote special or separate attention to what, after all, is only a part of a great therapeutical scheme. The essential thing is to take such a large view of the physiological and pathological processes, as will give the right indications to call upon each and all of the therapeutical agents at our command. To fix the mind too intently upon any one of those agents, is to incur the danger of neglecting others, and of losing sight of the principle which ought to guide the application of all, as one force directed to one end.

Having taken account of the poisons which threaten the pucrpera, and of the gates by which they may effect an entry, we shall be better able to protect her. Two great objects have to be kept in view: First, to keep all extrancous poisons out. Secondly, if any effect an entry, to counteract their noxious influences. A primary condition essential to the successful attainment of these two objects is to put the system itself in the best position for defence; that is, to secure the efficient working of all the organs concerned in nutrition and excretion. The carrying out of this programme fully is antiseptic midwifery in the broad sense. The adaptation of the Listerian or conventional antiseptic precautions is antiseptic midwifery in the partial and narrow sense.

Unfortunately, the first condition of effective resistance to toxemia is not always attainable. We must take the puerperal subject as we find her; perhaps with damaged kidneys or liver, deficient in nerve-power, in fibre, and with skin and lungs unequal to the new task thrown upon them.

About the third day is the epoch for the establishment of the absorptive process. The two days following labour are a period of rest. During this time the disintegration of the uterus and other superfluous structures is only beginning. The supply of waste-stuff for absorption is scanty. This can hardly be a source of fever. And if there be any blood or other matter in the uterus, it will hardly decompose under two

days or more, so as to yield septic stuff for absorption. But on the third day waste-stuff is pouring into the blood; decomposition may have begun in the cavity of the uterus, and active absorption finds material to work upon. Thus it is that febrility occurs on the third day.

1. The obvious lesson to be drawn from this history is to begin antiseptic treatment early. Indeed, it begins with the conduct of the labour. The first great point is to take care that the labour shall not be protracted. We must spare the system the evils of exhaustion of nerve-power, of loading the blood with the waste stuff resulting from severe muscular exertion. By timely aid in delivery we economise strength and diminish the risk of hæmorrhage; and thus, having a reserve of nerve-force and unimpaired muscular fibre, we have the most essential conditions for securing firm contraction of the uterus. It must be superfluous to dwell upon a point so universally recognised. The immediate object sought in securing contraction is to obviate hæmorrhage. And to obviate hæmorrhage is to oppose septicæmia.

Passing by the usual manœuvres exercised in dealing with the placenta, I will only insist upon the utility of the pad and binder. The compression exerted upon the abdomen and pelvis not only tends to provoke uterine contraction, but it counteracts the aspiration of suction-force, which tends to draw air, one of the factors of decomposition, into the uterus. It opposes centripetal osmosis. The day after labour it is useful to give an aperient. It commonly happens that, in the effort of defæcation, the uterus, compressed, and sharing in the diastaltic expulsive action, expels a clot. It then contracts more effectually. The maintenance of contraction is efficiently aided by oxytocics. It is our custom to give after every labour a mixture of quinine, ergot, and digitalis three times daily, continued for two or three weeks. The effect in contracting the uterus is remarkable. The patient will often say that she feels the womb contract soon after taking a dose. I look upon this measure as foremost in the scheme of antiseptic midwifery. It is shutting the gate in the face of the enemy.

2. The next thing is to wash out the uterus. Plain tepid water may serve the purpose, but a solution of carbolic acid, 1 in 50, or corrosive sublimate, 1 in 2,000, is better. This should be

done once or twice a day from the second day. On the first day, as we have seen, there is little risk of absorption, and it is important to disturb the patient as little as possible. Should there be the slightest rise of temperature and pulse, this intrauterine injection is imperative. Those who have used it can tell of temperature and pulse reduced, rigors and other signs of toxemia subsiding, after each injection, and ultimately enabling the patient to pull through the most threatening illness. The injection is best done by a gravitation or syphon tube. The uterine tube should be of glass. Thus a gentle, uniform stream is insured, all jerking propulsions are avoided, and it is easy to exclude air.

The beneficial action of carbolic acid or corrosive sublimate injections is threefold: First, the uterus and passages are washed out; secondly, the lining membrane of the passages is stimulated in a healthy manner, so that it is less favourable to the reproduction of foul stuff; thirdly, some small portion of the carbolic acid or sublimate penetrates the substance of the uterus, and is absorbed into the system, chasing and neutralising any poison that may have entered. Thus we follow the enemy through the gate which admitted it. The uterus and vagina, whilst serving as a septicode, are also made to serve as a passage for the antidote. This especially applies to iodine, which readily penetrates the uterine wall. We ought not to refer to intra-uterine injections to wash away septic stuff without grateful remembrance of Harvey the Immortal, who thus cured a lady in imminent danger of death from septicæmia. It is probable that this practice, although commonly neglected, has never been quite lost sight of. Thus, John Clarke (1793) has the following: 'An injection of the decoction of bark into the vagina (and uterus if it be possible) will be found useful, if it be only by washing out any matters that may be there.' Still, it is to Braxton Hicks that we are indebted for the revival of the practice. Tarnier extols a solution of bichloride of mercury, 1 in 2,000. He found it more effective in destroying bacteria than any other disinfectant. It has been much used in Germany. Thomas adopts it, and quite recently Lister has subjected it to close scientific and clinical testing, and speaks well of it. Dr. Garrigues, from relative observations in the Maternity Hospital at New York of the use of carbolic acid and bichloride of mercury as intra-uterine injections, declares that the great superiority of the latter antiseptic is proved. Dr. Hofmeier reports to the 'American Journal of Obstetrics' (1884) cases of poisoning from the use of bichloride of mercury, 1–1,000. In one case, profuse, partly bloody, diarrhea ensued. In another case death ensued. The subject was albuminuric, and the kidneys showed marked changes. Schroeder strictly forbids the use of corrosive sublimate when the kidneys are not absolutely sound. Tarnier's formula of 1–2,000 is the right one to adopt.

The manipulations necessary for intra-uterine injection give valuable information as to the position and other characters of the uterus. A not uncommon cause of retention of discharge is retroflexion or anteflexion. Reduction should, of course, be effected before injecting, and means taken to keep the uterus in situ afterwards.

Carbolic solution should be kept in the room. The catheter should be kept in it. The catheters should be made of annealed glass. If sponges are used, they should be kept in the solution; but it is better to exclude them, and use soft tow soaked in the solution, and burn it immediately after use. Instead of diapers, which it has been proved are a frequent source of contamination, as 'they come from the wash,' but not from purification, some such contrivance as the 'ladies' towel' should be used. These consist of light cotton-wool or tow, impregnated with carbolic acid or the sublimated-serum of Lister. They are burned after use. We have suggested the construction of a domestic apparatus for disinfecting linen by heat or sulphurous acid, through which all linen should be passed. The physician and the nurse should practise no manipulation without previously washing in carbolic solution, and lubricating the hand with carbolised vaseline, religiously rejecting lard and other animal grease. The chamber utensils should be rinsed with carbolic solution, and a little of the solution always kept in them.

3. Whilst taking care to exclude foul stuff from the genital canal, we must be careful to exclude foul air from the lungs and skin. A supply of pure air is an obvious necessity, but too frequently frustrated. When the sun shines, open the window. At night, especially, a fire is often the condition of good venti-

lation. If an Arnott's valve be adapted, the fire will then draw off the light foul air which rises to the ceiling, insuring a supply of fresh air from below. It is of the utmost importance to guard against chill or any check upon the due action of the skin, lungs, kidneys, and intestinal canal; that is, maintain in due working order the excretory organs.

4. Charles White insisted strongly upon drainage of the parturient canal. The patient, he says, should lie very high with her head and shoulders, and should sit up in bed when she takes her food and suckles, and kneel whenever she has occasion to make water. This frequent upright posture is of the utmost consequence. It prevents the lochia from stagnating, the stools and urine from being too long retained, and promotes the contraction of the uterus together with that of the abdominal muscles. But we have seen mischief from micturition in the knee-elbow posture.

Dr. Goodell has also insisted upon this plan. The principle is admirable. There is no doubt that, in the ordinary recumbent posture, blood and discharges are apt to collect in the lax uterus and vagina. Where a woman is strong, and after a few days, this plan may perhaps—we emphasise perhaps—be adopted without disadvantage; but in the weakly subjects most prone to septicæmia, especially after hæmorrhage, sitting up has been followed by syncope and sudden death. If firm pressure be maintained upon the hypogastrium, and antiseptic irrigations be duly observed, drainage is secured. At the same time, if the bed is properly made, so that the head and shoulders are kept at a slightly higher level than the pelvis, drainage will be fairly accomplished. The dorsal decubitus is more favourable to drainage than the lateral.

5. An effective barrier against the ingestion of noxious stuff from the parturient canal is to supply the system with healthy nutriment by the stomach. The more the system is supplied in this way, the less will it absorb from vicious sources. We believe Oldham was one of the first to lead the revolt against the old fashion of starving on gruel during the first week; and Graily Hewitt has ably taken up the cause. But it is easy to err in reaction. During the first two days the system craves rest as well as food. Food that is not easily assimilable is apt to load the stomach, lying undigested or

badly digested. Light broth, beef-tea, milk, toast, or eggs, plain or variously combined, are enough for the first two days. Gradually more solid food may be added. Light stimulants are occasionally useful, but, generally, alcohol may be dispensed with.

Closely connected with the care of the puerpera is the personal conduct of the surgeon and the nurse. As to the surgeon, it can hardly be necessary to insist upon the observance of the ordinary rules of cleanliness. We would only add one or two suggestions. Do not unnecessarily prolong the visit to the sick-room; do not perform any of the functions of a nurse. Avoid as much as possible the use of gloves; exposure to the light and air is the best of all disinfectants. Drive in an open carriage or ride; movement through the air not only blows away surface contaminations from the clothes, but it also cleanses the blood, and washes out of the system the impurities inhaled. Exercise in the open air on leaving the sick-room, by quickening respiration, promotes immediate oxidation of dangerous organic stuff that may have been absorbed.

To deny, as some men have done, the possibility of receiving or communicating zymotic and other poisons by the atmosphere, is to betray narrow experience or a judgment warped by preconceived theories. We ourselves have on several occasions suffered from dysenteric symptoms, the stools giving the characteristic odour and other qualities, from simply visiting dysenteric patients and examining their evacuations. We further entertain the conviction that we have thrown off poison, by brisk exercise in rowing or riding and a dose of quinia, that would otherwise have developed into serious illness. No one at the present day would dissect or attend the post-mortem room, and at the same time engage in obstetric practice. A healthy doctor will be more likely to have healthy patients.

As to the nurse, similar rules should as far as practicable be observed. Taking care that she does not encounter exposure to the risk of infection, she should get a run for at least an hour or two daily in the open air.

Especial care should be taken that she does not, on entering upon duty, come from attendance upon a doubtful case. She ought to bring a clean bill of health in the form of a certificate from her last abode. The most serious danger often lies hidden

in her clothes and linen. The same scrupulous care that is exercised as to the linen of the puerpera and child must be extended to the nurse. She should wear light-coloured washable cotton dresses.

We may summarise prophylactic midwifery in the following rules :— $\,$

- 1. Keep the door shut against the enemy by maintaining contraction of the uterus.
- 2. Prevent the enemy from forming and collecting by irrigating the parturient canal with antiseptic fluids.
- 3. Eject the enemy as fast as it effects an entry; that is, keep the excretory organs in activity.
- 4. Guard the lying-in chamber against the approach of foreign poisons. Admit no visitors. Watch the linen.
- 5. Fortify the patient against the attack of the enemy, by keeping up due supplies of wholesome food.
- 6. Exclude all emotional disturbances. Forbid writing letters.

Antiseptic Midwifery in Lying-in Hospitals.

Given fairly healthy subjects, scrupulously guarded in the manner described, women lying-in in their own homes will present but rare examples of fatal septicæmia. But when lying-in women are massed together in one building, the difficulty of safeguarding them is vastly greater. Perils gather around them in an accelerating ratio. If the history of many lying-in hospitals could be fairly written, we should have a terrible record of lives sacrificed to ignorance, to reckless disregard of medical authority, to architectural folly, to maladministration, to scandalous experimentation of fanciful crotchets. Uninformed benevolence, overriding the practical benevolence of science, has always been prolific of disaster. Nowhere can it count more victims than in lying-in hospitals.

In hospitals, septicæmia or other forms of puerperal fever manifest an active tendency to spread. Many of the so-called epidemics of puerperal fever in lying-in hospitals have undoubtedly been examples of the spread of zymotic fevers. But another class of apparent epidemics undoubtedly owe their origin and spread to contamination by what may rightly be called the 'puerperal poison,' meaning by this the product of

decomposition of blood and discharges in the parturient canal. The poison that one puerpera may thus make for herself may be carried to another puerpera, and so on through a ward. The fire quickly spreads when the fuel is at hand.

The first imperative condition for the safety of women in lying-in hospitals is the absolute single authority of the physician. If this be denied him, his duty to humanity and to his profession is to resign. This is the condition upon which he attends a private patient in her own house. It is infinitely more necessary that he should insist upon it when the care of many women in a hospital is thrown upon him.

A leading principle is to assimilate the conditions of each patient in a lying-in hospital as nearly as possible to those of the patient delivered at her own home. Isolate as much as possible. Take all care that any ill that may attack one patient shall be limited to her. Every hospital should have a room for disinfecting linen by heat or sulphurous acid.

A brief account of the scheme of the Paris Maternité devised by Tarnier, and described by him to the Obstetric Section of the International Medical Congress, in London, 1881, will be the best illustration of this principle carried into practice. Tarnier said that in 1856, when he was interne at the Maternité, the mortality was about 5 in 100; this was now reduced to 2 in 100 in the hospital generally, and to 0.75 in 100 in the pavilion he had had constructed a few years ago. The chief point in this pavilion is that each patient has a separate room, entered from the outside, so that a nurse can only pass from one room to another by going outside into the open air. The furniture is all of japanned iron; the floors, walls, and ceilings are of impermeable concrete. The mattresses and pillows are stuffed with oat-chaff, which is burnt after use in every single case. Instead of a mackintosh sheet, a sheet of brown paper made impermeable by pitch is used, and this too is burnt after use. He has used various antiseptic solutions for the washing of the genitals—borax, carbolic acid, sulphurous acid, and bichloride of mercury. As the result of experience, he concludes that a weak solution of bichloride of mercury is the most powerful germicide.

The description given by Dr. Fancourt Barnes of the system in force at the British Lying-in Hospital is a further practical

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illustration of the rules necessary to secure safety. Every patient is delivered under the carbolic spray. This disinfects nurses and pupils who are assisting, and prevents the entrance of germs or foul matter into the genital tract at the moment when it is distended and lacerated by the passage of the child. All washings, syringings, and examinations are done with carbolic solution. Carbolic spray, of 1 in 80, is nearly continuously playing in each ward. To secure contraction of the uterus, each patient has a mixture of quinine, ergot, and opium three times a day, for the first week. Since instituting the above practice, he rarely finds any rise of temperature during the lying-in.

We may thus hope to see the day when women can be delivered in lying-in hospitals as safely as in home-practice.

The curative treatment is more simple than are the genetic and pathological problems. It may be taken as a general fact that, whatever the form of the fever, the principle of treatment is much the same. The first indication is to persevere steadily in the application of the prophylatic measures. In the majority of cases these measures are still useful when the fever has declared itself.

The first rule is to isolate the patient as much as possible for her own sake, as well as in the interest of others. The next is, when practicable, to move the patient to another room. We have on several occasions seen marked improvement follow this step almost immediately. The positive treatment may be studied under three heads: (1) hygienic, topical, operative, and external; (2) dietetic; (3) medicinal. Following this order generally, we shall find it convenient to consider the special treatment called for to relieve particular symptoms or complications.

1. Topical treatment includes the use of intra-uterine injections. Some discrimination is necessary. If the lochia be offensive, it will generally be judicious to wash out the uterine cavity gently twice a day with corrosive sublimate solution or carbolic acid. If the pulse and temperature fall, and other symptoms improve after an injection, and thus a relapse ensue, it may be surmised that the fever is greatly due to renewed supply of noxious stuff. This is an indication to repeat the injection. If, on the other hand, after having once

well washed out the uterus and ascertained that there is no offending substance in it, and yet the fever gets worse, it will generally be better not to repeat the injection. The operation can hardly be done without disturbing the patient. It may, as Brauu says, do more harm than good. It is necessary to remember that eveu injections of plain water may cause death. As we have seen, when discussing the use of injections to restrain post-partum hæmorrhage, sudden death from shock has occurred. The addition of iodine, carbolic acid, or bichloride of mercury to injections administered in puerpery does not neutralise this danger. Convulsions have followed. Carbolic poisoning has been uoted. Fancourt Barnes has uoted black uriue in several cases in the British Lying-in Hospital, unattended, however, by any serious symptom. We have also noted iodism following upon iodine injections.

If diphtheritic patches be observed on the perineal wound or elsewhere, painting with nitrate of silver is the best plan. We might even inject nitrate of silver in solution, 1 in 10, so as to insure a more complete effect. In the ordinary case of perineal laceration the wound should be dressed from the time of labour with lint steeped in solution of chloride of zinc.

In the case of peritonitis in the acute stage, if the pulse is good, a dozen leeches will prove useful. Afterwards stupes of hot water, followed by a turpentine stupe, are serviceable. After this the best local treatment is that advised by Dr. de Latour. This consists in exclusion of air from the surface of the abdomen by a layer of collodion and castor-oil, and over this applying a sheet of cotton-wool, or, better, of the disinfected wood-wool. In the simpler acute cases, such as follow upon chill or exposure, the septic element being relatively insignificant, we have seeu good effects from applying fifteen to twenty leeches to the abdomen. This is sometimes usefully followed by spreading a layer of mild mercurial ointment with extract of belladonna on lint, and applying this to the abdomen. In all cases the abdomen should be exposed as little as possible.

It is a rule of great practical importance to limit internal examinations as much as possible. Having once ascertained the condition of the uterus as to contraction, position, and emptiness, examinations can do no good, and commonly do harm. Rest of

the organs and structures primarily concerned is of the first necessity. The same rule applies to external examinations. Palpation and percussion, gently practised, are necessary to ascertain the condition of the bladder, pelvis, and intestines; but these manipulations should be sparingly practised. The surgeon should especially watch over the bladder, since in addition to the risk of ordinary temporary paralysis, this organ is especially liable to defective action when there is fever or pelvic or abdominal inflammation. Diagnostic exploration can be carried out at the same time as catheterisation.

The question of how to deal with the breasts arises in this connection. Generally the secretion of milk is soon arrested; the breasts shrink, and seldom demand special attention. We refer to the section on 'Mastitis,' p. 396, for specific information.

The treatment of tympanites is partly operative. The distress and danger attending tympanites are due in some measure to the great pressure from distension. This impedes respiration, circulation, and other functions. If the tension could be reduced, corresponding relief might be expected. Braxton Hicks advocated abdominal punctures with this intention ('Obstetrical Transactions,' 1868-9), and related cases in illustration. A small exploring trocar is the best instrument. By it the intestine is pierced in three or four of the most prominent points. As Hicks says, 'The pressure of the gas on the sympathetic ganglia and nerves, and the tension of the tissues which they supply, add much to the collapse and vomiting. The least that can be claimed for the operation is that the last moments of the patient can be rendered comparatively free from suffering.' We have adopted the plan and can speak favourably of it. It must never be forgotten that tympanites is not necessarily a fatal symptom; and it may well be that relieving this symptom may conduce to recovery.

Another mode by which relief from tympanites may be obtained is by passing up into the bowel an O'Byrne's tube.

Injections of turpentine also are beneficial.

Tapping or abdominal incision has been advocated by Hervieux ('L'Union Médicale,' 1864) in some cases of serous and purulent collections in the peritoneum, on the same principle that is recognised in the treatment of pleuritic collections. He prefers the bistouri to the trocar.

Another operative measure is intra-venous injection. Tyler Smith ('Obst. Trans.' 1870) proposed in extreme cases of collapse to inject into the veins a mixture of one part of liquor ammoniae to three of water, to the extent of half a drachm. The case he related in support affords strong evidence of the value of this method.

In the discussion on Smith's case, we submitted that a better fluid than ammonia to inject would be a saline solution like that which Little used in cholera, adding a little ammoniate deserves consideration whether transfusion of blood might not be useful.

Refrigeration has been strongly advocated by Thomas. It should, he urges, be resorted to early. The method advised is the application of iced water by means of a rubber coil over the entire abdomen. In a communication to the International Medical Congress at Copenhagen, 1884, Professor Vincent, of Lyons, advocated this principle. He contended, (1) that the administration of cold baths was practicable in recently delivered women attacked with puerperal fever; that (2) cold baths were free from danger in the puerperal state; (3) they had a certain and quick antifebrile effect in the sequelæ of delivery; (4) recovery from puerperal fever was the rule with treatment by baths of proper temperature and methodically administered; (5) cold baths were indicated in all high temperature forms of after-complications of childbirth, the very acute peritonitis excepted. The indication for cold baths did not arise except where the fever was kept up, without notable morning remission, to about 40° Cent., when the powerlessness of quinine and diffusible stimulants in full doses had been shown, and when, in fine, the lochia were feetid, and intra-uterine injections had been carefully tried without bringing a fall in the febrile condition. (6) Cold baths should be administered at a temperature varying from 28° to 18° Cent.; according to the fall secured by the first bath, given at 28° or 30°, the temperature of the subsequent baths should be reduced. (The rule was, to get with a cold or tepid bath a fall of from one to two degrees of the patient's temperature.) The method used in typhoid fever, treated by cold baths after the system of Dr. Brand, should be followed, with modifications. (7) The cold baths were repeated every three hours until the temperature had

fallen to 38°, and stayed there, with only ascending oscillations of some tenths in the evening. (8) When baths of 18° or 20° Cent., repeated every three hours, night and day, did not bring about a notable reduction of temperature, a large ice-bag should be placed, in the intervals of the baths, on the abdomen of the patient. (9) Along with cold baths and ice-bags spirits and tonics should be freely administered; the patients should be fed with liquid or semi-liquid foods. Playfair placed the patient in a water-bed, into which cold water was pumped. Fordyce Barker, speaking from experience, is adverse to the practice. Our own opinion is in accordance with that of Barker.

2. Dietetic treatment. When fever has set in, the appetite and powers of assimilating nutriment fail. The question of feeding is commonly an anxious one. The plan of giving little and often is the best. The food must be in the liquid form, and not over-concentrated. Milk surpasses everything else, but it is not always tolerated. Beef-tea, freshly prepared, is to be preferred to the numerous extracts so pertinaciously thrust upon us as indispensable and incomparable. Some of these are, however, unquestionably valuable. Thus Brand's and Valentine's essences can often be taken when everything else is rejected; but it will not do lightly to try unknown things under conditions which constitute a dangerous experiment. Specially prepared turtle-soup is an excellent resource.

Injection of food into the rectum when the stomach rebels and the collapse is imminent is a method of great value. The injection should not be bulky. A very useful formula is three ounces of strong beef-tea, one ounce of brandy, and one drachm of oxide of bismuth. A little laudanum may be added if

indicated.

Stimulants, again, require to be given with discretion. Champagne iced, when the stomach is irritable, is useful. We have known old port prove the best stimulus. Good cognac is the spirit to be preferred. The quantity must be regulated by the indications of the case; Robert Barnes arguing that as at least a portion of the alcohol introduced into the circulation remained unchanged, it would pro tanto act as an antiseptic as well as a stimulus.

3. Medicinal treatment. The great indications are to

counteract the poisonous process going on in the system; to aid the excretory process; to allay fever; to mitigate pain; to obviate the tendency to exhaustion. Incidentally, indications arise dictated by complications.

Quinia combined with mineral acids is, if anything deserves the title, our sheet-anchor. It must be given freely in fouror five-grain doses. Various preparations of bark variously combined are occasionally useful. Playfair extols Warburg's tineture, and we can confidently endorse his recommendation.

Of salicylic acid we have not much experience. When we have given it we have been disappointed. The hypophosphites have not given us good results.

Tincture of aconite given in small doses—two drops every hour alone or with quinia—is often efficacious in reducing the pulse and temperature. Fordyce Barker speaks highly of the tincture of veratrum viride used with the same intention. But it is necessary to watch it carefully, and to drop it as soon as the pulse is lowered. We have been in the habit of combining digitalis with quinia. Digitalis is certainly safer than veratrum or aconite.

Sedatives are commonly necessary. Where opium is indicated, laudanum, acetate of morphia, or the sedative liquor, offer the best choice. They are best combined with the quinia and digitalis. Where medicines are not borne by the stomach, an enema containing twenty minims of laudanum with a scruple of chloral hydrate may be tried; a third of a grain of acetate of morphia may be injected hypodermically. Opiates are especially useful in the more acute and simple cases of peritonitis. In the more advanced stages of fever they are not well borne.

Purgatives are rarely indicated. Usually the bowels have been fully relieved before or during labour. And we have advised a gentle aperient of castor-oil tempered with a few drops of laudanum, or a teaspoonful of the compound liquorice-powder, on the second day after labour. When there is suspicion of feedal accumulation or of sluggish liver, half-grain or grain doses of calomel every two or three hours will commonly produce the most satisfactory results. When fever has declared itself, there is commonly a tendency to diarrhea. It is not desirable to seek to control this at once. But, whether we

regard this symptom as an eliminative effort or not, it is certain that when once diarrhea has set in it is too apt to continue as a flux, and help to exhaust the patient. And the drain of fluid from the circulation increases the already too active process of absorption. In most cases, therefore, diarrhea should be controlled. At first, three-grain doses of grey powder, with an equal quantity of Dover's powder, is the best remedy. Then astringents, as catechu, kino, cusparia, combined generally with opium, may be tried. Bismuth we have not found of much use except in the form of enema. Ferrie chloride is sometimes of singular efficacy in the worst cases of fever, attended or not by diarrhea.

Vomiting frequently attends upon diarrhoa, so that these two symptoms call for simultaneous treatment. The remedies recommended for diarrhoa are mostly serviceable in moderating vomiting. We have lost faith in hydrocyanic acid; bismuth cannot be trusted. Strychnia, combined with the quinia and digitalis, we have found valuable. A copious draught of hot water has produced an excellent effect; but later, ice alone, or with champagne, is better. If the vomiting merges into the convulsive type, especially with hiecough, the most effective plan is to let the patient breathe four or five drops of nitrite of amyl at long intervals. If the habit of vomiting be interrupted even for a short time, these distressing symptoms are more easily subdued. Cajeput oil, in doses of two or three drops on a lump of sugar, is sometimes useful in these conditions.

Summary of the Discussion of Puerperal Fevers.

The following fundamental propositions may be stated:— By the term 'puerperal fever' we must understand 'fever in a puerpera.'

As fevers of various kinds may assail non-puerperal persons, so they may assail puerperæ. We must therefore abandon the vain attempt to find one definite puerperal fever, and we must recognise the clinical truth that there are puerperal fevers.

There is, however, one constant underlying condition of all the puerperal fevers—that is, the puerperal constitution. This puerperal constitution is the soil in which all the disturbing influences work, in which noxious matters, from whatever source, germinate; and which, without always destroying the individual properties of the foreign poisons, imparts to all some common features. It is also highly probable that, under the mutual reactions of ingested poisons and the puerperal constitution, new innominate poisons may be engendered. The puerperal fevers may be classified under the two great divisions of Autogenetic and Heterogenetic.

A. The Autogenetic fevers are: 1. The simple excretory pnerperal fever, the result of endosepsis, or the arrest of the excretion of waste-stuff of involution. This form complicates all other fevers. It is in itself the only true puerperal fever.

2. The fever resulting from absorption of foul stuff from the parturient canal, either from unbroken mucous surface, or by the open mouths of vessels, or from traumatic surfaces; this is auto-septic. This form also is likely to complicate other fevers.

3. This, the proper septicemic puerperal fever, is revealed under the forms of metritis, peritonitis, pelvic cellulitis, thrombosis, and general toxemia.

B. The Heterogenetic fevers, due to the reception of a poison from without. These may be subdivided into (1) the cadaveric poison, the septie stuff from other puerperæ, animal poisons of obscure origin; and (2) the known zymotic poisons, as small-pox, scarlatina, typhoid, diphtheria, erysipelas.

All the various modes of infection recognised as acting in non-puerperal subjects act in the puerpera. But she is especially open to invasion by direct inoculation of the parturient tract; and empoisonment by the ordinary routes is enormously favoured by the peculiar activity of the absorptive function of the puerpera.

Epidemics of puerperal fever have, in many instances, been traced to zymotic influences, especially to scarlatina and erysipelas. Hospital epidemics, especially those not marked by concurrent epidemies in the community outside, are more commonly traced to erysipelas, eadaveric inoculation, and hospital malaria.

Pathological anatomy fails to differentiate the fevers. The most distinctive anatomical changes are those seen in pelvie inflammations and thrombotic fevers. In cases of various origin the anatomical changes may exhibit close similarity.

This constancy of pathological effects illustrates the proposition that all the fevers acquire some common character from the underlying purperal constitution.

In the cases of general toxemia, the pathological changes are rarely limited to particular organs or tissues. In many cases several organs and tissues are affected. The most common conditions in fatal cases are suppurative peritonitis, uterine phlegmasia and lymphangitis, metastatic abscesses in liver, spleen, kidneys, lungs, and serous inflammations. Less frequent conditions are synovial inflammations, diffuse cellular inflammations, and sloughing, pneumonia, ophthalmia.

The symptoms at the onset of a puerperal fever rarely indicate with precision the source or nature of the fever. Most are ushered in by the common signs of toxemia. Differentiation, or the identification of the particular poison at work, is established sometimes by watching the clinical evolution of the disease, by the antecedent history, by scarch into the surrounding influences; and not seldom the problem baffles solution. We must, then, be content with the general fact that we are dealing with a puerperal fever.

The lesson of paramount importance drawn from the history of puerperal fevers is to pursue keenly the study of the causes and the modes of infection. In this study lies the secret of successful prophylaxis. Medical treatment of the severer forms of puerperal fever is proverbially disappointing. But we may hope to stamp them out. It is a case that calls for the widest and the most minute applications of the resources of hygiene.

CHAPTER X.

THE ARMAMENTARIUM OBSTETRICIUM.

It is useful to describe the instruments and other means at our disposal before describing the cases which call for their application.

At the head of all obstetric instruments is the obstetric

hand.

The contents of the obstetric bag.

A. Instruments to save the child. Conservative. 1. Lever, superfluous. 2. A long double-curved forceps. 3. Roberton's or other contrivance to return prolapsed funis. 4. Richardson's or Ribemont-Dessaigne's apparatus to restore the child from asphyxia.

B. Instruments to reduce the bulk of the child. Sacrificial.
5. A craniotome or perforator. 6. A crotchet. 7. A craniotomy-forceps or cranioclast. 8. A cephalotribe. 9. A strong wire écraseur and embryotomy-scissors. 10. Ramsbotham's or Braun's decapitating hook. 11. A blunt hook slightly flexible.

C. For Cæsarian section and restoring perinæum. 12. Bistouri, director and scissors for laparatomy; sutures; ligatures; needles; needle-holder; artery-forceps. For Porro's operation: Koeberlé's serre-nœud, Cintrat's ligateur, or an elastic band. Sydney Jones's ovariotomy clamp-forceps to seize the bleeding edges of the uterine wound.

D. To induce or accelerate labour. 13. A blunt-ended straight bistouri to incise the cervix in cases of occlusion, extreme contraction, or cicatrisation. 14. A Higginson's syringe with a flexible uterine tube nine inches long, or, better, a grooved glass tube on Neugebauer's model, for injecting hot or cold water or styptics, or for antiseptic irrigation. This also serves to expand, 15, a set of Barnes's hydrostatic dilators. 16. Three or four male elastic bougies,

Nos. 8 and 9. 17. A flexible male catheter or a glass catheter. 18. A porcupine quill to rupture the membranes is useful. 19. Seissors and thread.

E. To restore the mother. 20. A hypodermic syringe to hold 60 m. 21. A transfusion apparatus.

F: Medicines. 22. Chloroform or ether for anæsthesia. Ether for subcutaneous injection. 23. Chloral. 24. Laudanum.

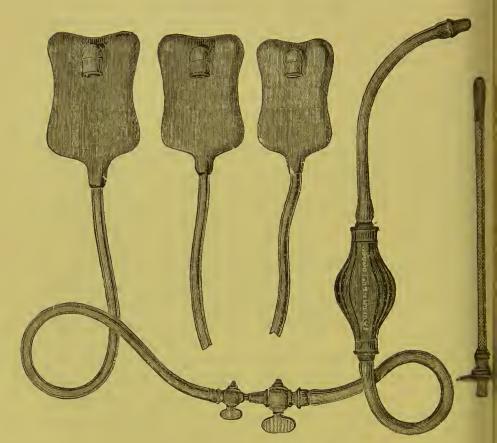


Fig. 55.—Barnes's Hydrostatic Bags and Syringe.

25. Nitrite of amyl. 26. Nitro-glycerine; some may be carried in Martindale's capsules. 27. Ergot of rye. 28. Perchloride or persulphate of iron. Tincture of iodine. 29. Carbolic acid. A solution of mercuric chloride of definite strength, 1 in 20, so that by adding 100 parts of water we get a solution of 1 in 2,000 for use. 30. Vaseline with carbolic acid, 1 in 20, or boracic acid. This may be carried in an

rtist's colour tube. Cold cream, lard, oil, may be impure, and should be rigorously discarded.

We may now consider briefly what arc

The Essentials of Effective Instruments.

The forceps. A true long forceps is one which, whilst seizing the head at the pelvic brim, has its lock and handles lear outside the vulva. The model in most general use is probably Barnes's. This has a moderate head-curve, a moderate pelvic curve, and straight handles. The forceps known as J. Y. Simpson's, still used, is really a short, or at best an intermediate, forceps.

The forceps should be plated with nickel to prevent rust.

The invention of the midwifery forceps. Dr. Aveling has, in his 'Memoirs of the Chamberlen family,' settled this question as nearly as it is possible to do so. In 1569 William Chamberlen and his wife fled, with other Huguenots, from Paris and landed at Southampton. They had two sons—Peter the elder and Peter the younger. Peter the elder, who was born in Paris, there is the strongest circumstantial evidence to make us believe was the inventor of the midwifery forceps. The invention has been very generally attributed to Dr. Peter Chamberlen, the son of Peter the younger, but Dr. Aveling has shown this to be an error. Great confusion has resulted from the fact that the three Peters were all alive at the same time, and two of them were brothers. The instruments used by the Chamberlens are in the possession of the Royal Medical and Chirurgical Society of London.

Since the introduction of the forceps two principal types have ruled, and recently a third type has been added. Each has undergone numerous modifications, more or less important. Indeed, so many have been the inventors of varieties of forceps that Pajot wittily observed 'that he does not reproach a man for having invented a forceps, since that might happen to anyone.'

Type the first. The characteristic of this is that it possesses one curve only; the blades are curved to seize the head. The chief feature of this type is that the whole instrument is essentially short, adapted to seize the head when low in the pelvis. It is commonly called 'the short forceps.'

This type prevailed generally in this country until Smellie's time; and, indeed, with rare exceptions, until quite recently.

Type the second is marked by the introduction of the pelvic curve. It is thus adapted to follow the curve of the sacrum and the axis of the pelvis to the brim. The advantage is enormous, since it admits of seizing the head high in the pelvis and even in the strait. It was introduced in France by Levret, in 1747. It has become the classical French forceps. It was introduced in England by Smellie, in 1752, and used by some of his contemporaries.



Fig. 56.—Aveling's Sigmoid Axis-traction Forceps.

Type the third is distinguished by the introduction of a third curve, the perinæal.

Hermann, of Berne, added a curve to clear the perinæum. This curve is made in the shanks. It does not well admit of axis-traction, the great object of the third curve.

The greatest share in the invention of the modern type of axis-traction forceps must be awarded to Aveling, who exhibited the first true sigmoid curved forceps to the Obstetrical Society on the 4th of March, 1868. This forceps is figured, fig. 56. The perinæal curve is provided in the handles, which serve for traction.

Tarnier's axis-traction forceps in its first form was made known in 1877. He produced a number of modifications in it before settling the latest—possibly not to be the last—model (see fig. 57).

It is distinguished from Aveling's by the perinæal eurve being provided with special traction-bars attached to the lower ends of the fenestræ; the handles themselves, having first served to introduce the blades and adjust them to the child's head,

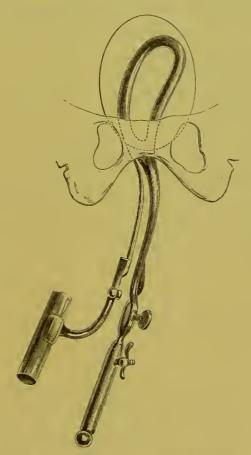


Fig. 57.—Tarnier's Axis-traction Forceps.

thenceforth merely serve as index-needles, showing the progress of the head, by rising upwards towards the abdomen in proportion as the head traverses the pelvis in Carus's curve.

The principles on which a true foreeps acts are so important to be rightly understood, that we give Tarnier's illustrations. His argument applies in fundamental truth to all foreeps, but it proves that the great object of axis-traction can only

be well carried out by the adaptation of the perinæal curve. Tarnier claims three distinctive advantages for his instrument:—

1. It is the best adapted to draw in the pelvic axis. He illustrates this proposition in the following manner (see fig. 58):—

'The figure represents an application of the foreeps at the brim. The line AB indicates the axis of the opening which the head must traverse, and, therefore, the direction the tractions must take to be correct. But when the operator pulls upon the handles of the forceps, the tractions he makes are

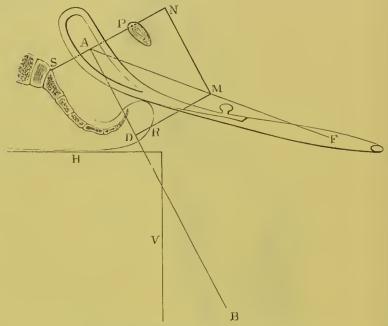


Fig. 58.—To illustrate Axis-traction. (Tarnier.) n y. Horizontal and vertical lines of a table. s. Sacrum. p. Pubes.

converted into a force represented by the line A F. Supposing that these tractions equal 40 kilogrammes, and that they be represented by the distance A M, and we construct upon this line A M the parallelogram of forces A D M N, we find that the traction A M is decomposed into two forces—the one, A D, which tends to lower the head in the direction of the axis of the brim; the other, A N, representing a vicious pressure which falls upon the pubes. Now, the lines A M, A D, A N present different lengths, which are expressed by the numbers 40, 30, 26, in round numbers. Therefore, in pulling upon the handles

of the classical forceps with a force of 40 kilogrammes, one tends to lower the head in the direction AD with a force of 30 kilogrammes only, whilst involuntarily the pubes is subjected to a vicious pressure of 26 kilogrammes. It must be understood that in this calculation I have taken into account simply the forces and the pressures arising out of the act of the operator, neglecting those which proceed from the natural action of the mother's tissues.'

He thus demonstrates that it is impossible to pull in the axis of the upper strait or brim, and to avoid vicious pressure by grasping the handle of the ordinary forceps. Those who object to Tarnier's forceps insist that, by the well-known manœuvre of pulling on the handles with one hand, and at the same time pushing back upon the shanks with the other, the direction of the traction is changed to that of the axis. We are convinced, from long practice and many close observations, that the correction thus obtained is inconsiderable, and that Tarnier's demonstration is true.

Tarnier next applies a like method of demonstration to the action of the ordinary forceps in the cavity and outlet, showing that in these cases also there is waste of force and vicious pressure. To a less extent than in the case of the brim, his argument is sustained.

- 2. The traction-force is applied as nearly as possible to the centre of the child's head. This is a main condition of axistraction, and it does not impede the rotation of the head. It ensures a great economy of force.
- 3. An index-needle is provided, which serves to indicate the advance of the head, and to guide the direction of the traction-force. This index is constituted by the handles of the forceps, which rise as the head descends in the pelvis, following the curve of Carus.

In his first forceps Tarnier adapted the perinæal curve to the handles themselves as well as to the traction-bars. This rendered the introduction and working of the instrument difficult. It is obvious that, traction being made by the special curved traction-bars, the perinæal curve of the handles of the forceps is superfluous. Accordingly Tarnier has abandoned it. His last model has the handles straight, as in the classical forceps. This arrangement makes it more easy to adjust the

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blades, gives more room for working the traction-bars, and the handles serve as more precise index-needles. We have used this model several times with the greatest satisfaction.

Upon the whole, we think the index-needle principle may be dispensed with. The main advantage of axis-traction can be secured by giving the perinæal curve to the handles, which serve for traction. We may trust to the sentient hands to determine the progress and position of the head, and the direction in which traction is to be used.

Many modifications of Tarnier's forceps have been proposed, notably by Lusk and A. R. Simpson.

We have used Simpson's, which the Professor lengthened at our suggestion, and find it work well. But we are unable to find any definite improvement upon Tarnier's last model.

We must also notice the two forms of lock which bind the blades of the forceps when adjusted to the head. These are known as the English and the French locks. The first consists in the fitting of one shank into a notch in the other. The French lock consists in a projecting button on one shank, on to which a notch in the shank of the other blades slides. When adjusted, the lock can be fixed by screwing down the button. The French lock has many advantages.

Many ingenious modifications of the forceps have been contrived, under the idea of substituting machinery for the hands to execute the traction and extraction. Pulleys working between the forceps applied to the head and a fixed point outside the body have been the chief means. The force used is regulated by a dynamometer. The contrivances of this order are chiefly associated with the names of Chassagny, Joulin, Pros, Poullet, Tarnier. The force used is for the most part continuous and uniform, not intermittent and variable as when manual force is used. Most of these apparatuses are described and figured by Charpentier. We do not enter upon details concerning them, since they are not likely to come into use. Indeed, they have made little way in France. Some objections are obvious: 1. To substitute machines for the hands is to abandon intelligent observation and regulation of the progress of the labour and the force employed which the hands alone can supply. 2. The blades may slip from the head without warning. 3. The lateral or leverage action which so much

economises traction-force and lessens pressure upon the pelvic walls is lost. Experience of deliveries by machinery has not

given good results.

The craniotome or perforator must be straight and powerful. Oldham's is a very efficient instrument. The instruments known as 'Smellie's' and 'Naegelé's' are weak and inefficient. All perforators curved in the blades are bad. It is difficult with them to strike the cranium in exact perpendicular, an essential condition to avoid deflection at a tangent, and to prevent the head rolling over under the impact of the instrument.

Fig. 59 is a form of perforator used by Tarnier. It is easier to use when the head is movable above the brim than the spear-headed perforator, and it makes a good aperture in the

cranial vault.

In Germany, France, and Italy trepan-perforators have found favour. We have tried one of the best, Professor Martin's, of Berlin. The objections are, first, that in the most difficult cases the trepan takes up too much room to be applied accu-



Fig. 59.-Tarnier's Perforator.

rately; secondly, the opening made by it in the cranium is insufficient, and the vault or arch of the cranium is not sufficiently broken up to admit of easy crushing in. Oldham's perforator will run up in the merest chink, and break up the cranial vault enough for all purposes.

The most unyielding part of the skull is the base. To break up this several instruments have been contrived. Hubert, in 1860, proposed an olive-shaped screw at the point of a long steel rod. This first perforated the vault, and then was passed on to the base and screwed in at this part. An unfenestrated blade, passed over the head, received its tip, the point of the screw, when this had pierced through the base of the skull. In 1865 Guyon practised intra-cranial cephalotripsy by means of an instrument consisting of a trephine which perforates the vault, of a second smaller trephine which, guided by a stiletto to the base of the skull, saws out a disc; several discs may be so removed, and then a light cephalotribe crushes in the head easily. This works effectively.

A. R. Simpson's basilyst, as its name implies, is intended specially to break up the base of the skull, and thus more completely to secure reduction of the bulk of the fœtal head. The



Fig. 60.—Simpson's Basilyst.

basilyst is made to perforate the cranial vault, and then to traverse the cranial cavity and perforate the base. As will be

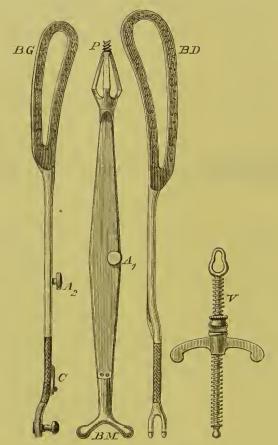


Fig. 61.—Tarnier's Basiotribe.

The instrument is composed of four pieces: 1st, the left blade, B.G; 2nd, the middle blade, or perforator, B.M; 3rd, the right blade, B.D; 4th, the compressing screw, V. A_1 and A_2 show the locks. C is the eatch to unite the left blade to the middle blade.

seen by comparing the figures, its perforating end is conical and of similar shape to Tarnier's perforator.

'The depth to which it can be screwed in is determined by the shoulder, which projects all round the base of the screw; and in a case where a small trepan-like opening is desired, all that the operator has to do is to screw it in up to the shoulder, and then withdraw it. Ordinarily, however, a wider gap is required, and then the operator will compress the handles so as

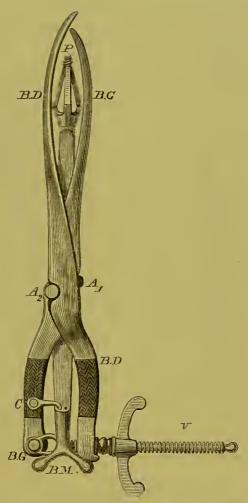


Fig. 62.—Tarnier's Basiotribe; the pieces all united

to separate the points and expand the aperture to the requisite extent.'

Tarnier's basiotribe is a combination of the perforator with the two blades of the cephalotribe.

The instrument has the following dimensions and weight: The length is 41 centimetres; the breadth from one side to the other, when articulated, is 4 centimetres; the weight is 1,200 grammes. The instrument is applied in the following manner: The middle blade is made to perforate the cranial vault, and then held while the smaller or left blade is applied and screwed up on to the middle blade; the right or larger blade is then applied and screwed up on to the other two blades. The instrument is then united as shown in fig. 62.

The advantages are, that the instrument cannot slip off the fætal head during the crushing, and that the crushing is much more complete than when done by the ordinary cephalotribe. The overlapping of the right blade, which is the last to be applied, secures thorough crushing of the head and prevents slipping.

The craniotomy-forceps or cranioclast should have the prehensile portion of the blades very slightly curved, duckbilled, and so made as to grip with the fenestræ perfectly parallel. Thus made, the bone and scalp being seized over a large surface, there is little fear of breaking and tearing away. It must be made of two distinct blades, joining by a French lock after adjustment, and adapted with a compressing screw at the extremity of the handles, so as to save fatigue in compressing and to reserve the operator's strength for traction. Barnes's and Hall Davis's work well. Braun's is too much curved in the blades to take an equally diffused wide grasp.1

The cephalotribe. It should be long enough to seize the head above the brim; stout enough not to 'spring' or bend under powerful resistance; slightly incurved at the prehensile end and roughened inside the blades. It should be provided with a compressing screw at the handles to secure the grip.

The continental models are mostly unnecessarily bulky. Kidd's model, a straight one, is good. Fancourt Barnes's is a most efficient improvement. The instrument is made lighter without losing strength by the blades being fenetrated (see fig. 63). We can affirm from experience that it works well.

We think it desirable to make a correction. Charpentier (p. 818) says : 'Barnes décrit ainsi son procédé; il se sert du cranioclaste de Braun.' There are essential differences between Barnes's and Braun's instruments. Barnes's was modified from Simpson's. It was made by him with successive improvements in 1862, 1863, and 1864. It might be further improved by giving it a slight perinæal curve.

It is longer than any other English cephalotribe, and is easily adapted to the head above the brim. The perinæal curve enables the operator to seize the head in its transverse diameter, thus preventing the blades from slipping backwards, as the ordinary cephalotribes are apt to do during the crushing of the head. Tarnier has also adapted the perinæal curve to the cephalotribe.

Reduction of the head-globe by lamination or slicing is

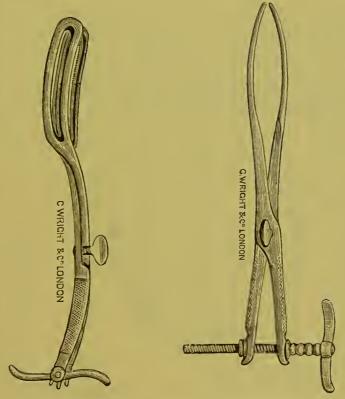


Fig. 63.—Fancourt Barnes's Axis-traction Cephalotribe.

a thoroughly scientific operation. It has been practised by Barnes and Tarnier.

A powerful embryotomy scissors is sometimes useful for decapitation, and for dividing the spinal column in cases of advanced evolution.

Ramsbotham's decapitating hook has a moderately cutting inside edge. It is an efficient instrument. In Germany and Italy Braun's blunt hook is preferred, perhaps with reason. It is twelve inches long; the greatest width of the hooked part

is one inch; the stem is from four to five times thick. Lazzati introduced a gentle curve into the stem near the hook.

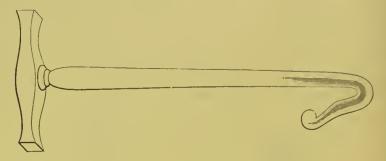


Fig. 64.—Braun's Decapitator.

An improvement on these hooks will be found in Dessaigne's embryotome (see figs. 65, 66).

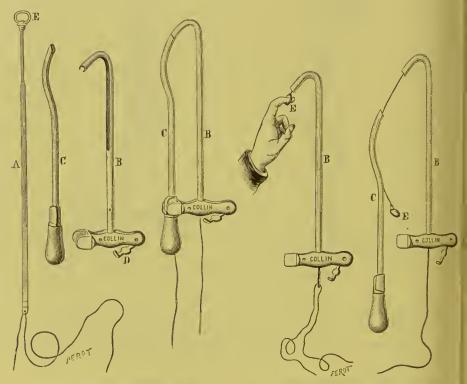


Fig. 65.—Dessaigne's Embryotome.

Fig. 66.—Dessaigne's Embryotome.

Ribemont-Dessaigne's embryotome is an ingenious instrument which enables a cord to be passed over the neck or trunk of the fœtus when it is wished to perform decapitation or detruncation. The part B is passed over the fœtus in the same manner as Ramsbotham's decapitator; the part C is passed up to meet B, into which it is fixed by the clasp D; the conductor A E then draws the cord through the instrument so as to leave two free ends. These ends being drawn to and fro in the manner of a chain saw quickly and easily bisect that portion of the fœtus embraced by the embryotome. The instrument is easier to apply and easier to manipulate than the ordinary decapitator.

Barnes's hydrostatic bags. Many defective models are sold. There should be a series of three. The general shape is that of a fiddle. The upper border should be slightly concave, so that the head-globe may rest in the concavity. The sides should be concave, so as to be embraced by the cervix, thus obviating slipping into the uterus or back into the vagina; the distending force is thus expended upon the cervix with slightly superior force at the ora internum and externum. They should be made of good indiarubber. They are introduced by help of a sound, which, fitting into a small pouch near the fundus, carries the bag up into place. The permanent sound running in the centre of the bag, which some have thought an improvement, is really a fault (see fig. 55, p. 508).

To carry the whole of the foregoing armamentarium in one bag would be generally inconvenient. The best plan is to stow in one bag the instruments and medicines most frequently needed, including the essentially conservative appliances. These are: the forceps; Roberton's instrument to replace the funis; an apparatus to restore the child from asphyxia; bistouri and scissors; sutures; ligatures; elastic bougies; elastic or glass catheter; Higginson's syringe with Neugebauer's glass uterine tube; the hydrostatic dilators; a hypodermic syringe; Aveling's transfusion apparatus.

Medicines: chloroform or ether; ether for subcutaneous injection; tincture of opium; nitrite of amyl; ergot; perchloride of iron, solid; carbolic acid, 1 in 5, for dilution; bichloride of mercury, solution, 1 in 20; carbolised vaseline.

The things specified do not occupy much room. They will carry the obstetrist through most of the emergencies of labour. When it becomes a question as to sacrificing the child, there is generally time to send for the sacrificial instruments, which may be kept in a separate case.

CHAPTER XI.

DYSTOCIA: DEFINITION; DESCRIPTION. DISTINCTION BETWEEN SYMITOMS AND CAUSES: THE SIGNS; THE CAUSES. OF DERANGEMENT OF THE THREE FACTORS OF LABOUR: (1) DISORDER OF THE EXPELLING FORCE; EXCESS, DEFECT: FROM FAULT IN THE PASSAGES, SOFT PARTS, CERVIX UTERI, VAGINA, VULVA, UTERINE TUMOURS, EXTRA-UTERINE TUMOURS. PROLAPSE OF THE UTERUS; HYPERTROPHIC ELONGATION OF THE CERVIX; PREGNANCY IN ONE HORN OF BICORNUTE UTERUS. (2) DEFORMITIES OF SPINAL COLUMN AND PELVIS; THE RICKETY PELVIS; OSTEOMALACIC PELVIS; TRANSVERSELY CON-TRACTED PELVIS; KYPHOTIC PELVIS; FUNNEL-SHAPED PELVIS; SPONDYLOLISTHETIC PELVIS; OBLIQUELY OVATE PELVIS; THE THORNY PELVIS; TUMOURS; FRACTURE; THE SPLIT PELVIS. (3) FROM FŒTUS: MALPOSITIONS; PATHOLOGICAL CONDITIONS. CLINICAL CLASSIFICATION OF CASES OF DYSTOCIA; IMPACTION; ARREST.

The term 'Dystocia' comes down to us from Hippocrates. Dystocia stands in contrast to Eutocia. In the chapter on labour the meaning attached to the word 'eutocia' has been sufficiently illustrated. Definitions of complex states are difficult, if not impossible. The more we endeavour to fulfil the great desideratum of a definition, to be concise, the more shall we be wanting in precision. We may, however, usefully accept the following propositions as generally true: 'Eutocia is labour proceeding smoothly and terminating favourably under the natural forces.' On the other hand, dystocia may be defined or described in the words of Harvey: 'Fit partus difficilis et laboriosus quod nec modo neque ordine debito res peragatur, aut pravis aliquibus symptomatibus impediatur.' To this may be added labours requiring assistance.

The problem of dystocia is often needlessly obscured

by confounding definition and symptoms with causes. The surgeon, at the bedside, must pursue the clinical and analytical method, if he would solve the problem in a manner useful to the patient. He must carefully observe the symptoms, subjective and objective, and then proceed to weigh their significance and trace them to their causes.

We start, then, by observing the course of the labour. The points for observation are: (1) the time spent in the process; (2) the character of the pains; (3) the effects upon the system generally. In this way we shall determine whether or no the case is going on smoothly, or if the woman is drifting into danger, and what are the symptoms that dictate the necessity for interfering.

Having arrived at the conclusion that help is needed, we then search for the cause of the dystocia; and remembering that dystocia may arise from error in any one or more of the three factors of labour—that is, of the body to be expelled, of the resisting force or of the expelling force, or from a loss of correlation between these factors—we may, by careful investigation into the conditions and relations of these factors, hope to arrive at precise indications for treatment.

The scheme of this chapter, then, will be: (1) to describe the symptoms of dystocia; (2) to study the causes according to a systematic classification based upon the deviations from the standard characters of the several factors of labour; (3) then to revert, in conclusion, to the clinical classification of cases of dystocia. On this principle, then, we shall first study the defects or disorders of the expelling force; next, the difficulties arising from unfavourable conditions of the parturient canal, whether in its soft or bony elements; and, thirdly, the difficulties that arise from the fœtus, whether from disproportion, malposition, or other complications.

A. The Signs of Dystocia.

1. The general signs are: Pain, affecting the heart's action; a kind of shock; irritability of temper; anxiety; restlessness; continuous pain, exacerbated on return of the uterine contraction; tenderness on pressure upon the uterus; the nterine contractions assuming a peculiar abortive or fleeting

character—that is, having a wearing, irritating effect upon the system, and leaving a sense of having been of no use in advancing the labour—'they do no good.' The woman, instead of aiding 'the pains' with a cheerful will, dreads their return, is careful not to add force to efforts which she feels will be useless and which exhaust her strength. If with these symptoms the pulse rise to 100 or more, and maintain a high rate during the intervals of uterine contraction; if there be a hot dry skin or profuse perspiration, a scanty secretion of high-coloured urine or vomiting, which is now of ominous import, being no longer the result of healthy reflex excitation, but of prostration and metastatic or perverted nervous action, there is obstructed labour.

The local signs. When, in addition, tactile examination discovers great tenderness and heat of the vagina, tumid or unyielding state of the os and cervix uteri, continuous rigidity of the uterus, spastic contraction in the intervals of the pains (Braxton Hicks), stationary position of the fœtus, increasing tumefaction of the scalp or other presenting part, and exudation of a yellow serous discharge, there is dystocia. The surgeon is called upon to act. His first duty is, plainly, to discover the cause of the dystocia; the second, is to study and to apply the proper remedy.

The element of time must be considered. Dystocia, it is true, cannot be indicated by the clock. Although the signs enumerated are not often developed in a few hours, estimates based upon time are mostly fallacious. It is difficult to tell with any preciseness when labour began, so as to obtain a point of departure for calculations. Lingering during the first stage is not generally attended by much constitutional or local disorder. But, generally, the signs of dystocia will not be long deferred after the rupture of the membranes. Then, if severe pains continue to recur, and the labour makes no satisfactory progress, the question of giving help becomes urgent.

B. The Causes of Dystocia.

We first inquire: Does it lie in disorder of the expelling force? The expelling power may be faulty in two principal ways: in defect or in excess.

Defect of expelling power may vary in degree. There may be enough to drive the child through slowly, tediously, constituting lingering labour. There may be power enough to drive the child a part of the way, when the force flags or ceases. This is what is understood by *inertia*. The term is relative.

If, after some hours, the signs of dystocia not being deveoped, we find the labour at a standstill and the pains deficient, and if, on internal exploration, we are satisfied that the pelvis and soft passages offer no obstruction, if the fœtus present favourably and offer no obstruction from disproportion, we infer that the fault lies in defect of expelling force. The history of previous labours will serve to solve the question of pelvic deformity.

Inertia is compensated for in two ways: by adding force à tergo, and by applying force à fronte. Putting aside oxytocics, the objections to which will be set forth presently, we will only state here that vis à tergo is best applied by 'expression,' and vis à fronte by the forceps.

Excess of expelling power. This may be inferred if the contractions are strong and regular and yet fail to propel the child. Excess of expelling force may be the result of undue call upon the diastaltic function in answer to undue resistance. It implies, then, a want of correlation between the factors of labour. It is therefore necessary first to determine if there be obstruction; and if this cannot be readily removed, the rational course will be to moderate the driving force, lest injury to the soft parts or to the fœtus result. By the judicious use of epichontocics, as chloroform, nitrite of amyl, or chloral, violent action of the uterus may be subdued, and time given for the application of vis à fronte, should this be called for.

Dystocia from fault in the passages or undue resisting force. The fault may lie in the condition of the soft parts, or in that of the bony canal. It is convenient in the first place to enumerate the difficulties that arise from the soft parts. The first obstruction is encountered at the cervix uteri. This refuses to expand to receive and transmit the child. There may be rigidity. The os externum is felt hard, as a tight ring, unyielding under strong driving force. This condition is due in some cases to hyperæmia, hyperplasia, or hypertrophic induration. This is especially the case in pluriparæ. It

may be simply spasmodic, the result of loss of harmony between the expelling and resisting forces. This is metastatic nervous action, or perverted polarity, the excess of contractile energy being transferred from the fundus uteri to the cervix. This occurs not unfrequently in primiparæ. A frequent cause is premature escape of the liquor amnii, so that, the natural dilating factor wanting, the presenting part of the child comes to press directly upon the cervix.

Other obstructive conditions are: swelling of the cervix from thrombus, a fibroid tumour, cancerous degeneration. A condition commonly described, but very rare, is occlusion of the os by a false membrane (Naegelé). Occasionally, it is very difficult to make out the os uteri; there is nothing but a smooth surface at the vaginal roof. But with care and patience a small dimple will almost always be found, which represents the os. In one case, although the lips of the cs could be distinguished, a thick membrane was continuous with the circumference, completely closing it. This membrane we concluded to be formed by chorion and amnion, which had become closely adherent to the lower zone of the uterus. In a case under Dr. Fancourt Barnes, at the British Lying-in Hospital, of a young primipara, there was complete atresia of the vagina from one inch of the vulva upwards, excepting a minute canal, admitting a probe with difficulty. When in labour, no presentation could be felt through this obstruction. It was dissected up by the knife, and the uterus reached. The dilatation was enlarged by stretching with the fingers; a living child was delivered by forceps. Notwithstanding the severe injury inflicted, the patient made a good recovery. Beyond a history of scarlatina when a child, no fact bearing upon the atresia was elicited.

Although it can rarely occur that dystocia is due to one simple cause—for any one cause is almost sure to entail other disturbances, so that dystocia is almost necessarily a complex condition—it is convenient to trace separately the methods of treating the dystocia that arises from fault in the soft passage.

In the first place comes the question of how to act when there is *inertia*. This raises at once the question of the uses and dangers of ergot and other oxytocics. We seek by this aid to excite the uterus to more vigorous action. Before re-

sorting to them, it is of vital importance to determine first the whole conditions of the labour, the individual state of each of the three factors, and their correlations. Before whipping up the uterus to increased exertion, we must be satisfied that there is no obstacle in front so great that reasonable increase of driving force will not overcome without injury. We must be sure that there is no marked rigidity along the parturieut tract, no distortion or contraction of the pelvis, no disproportion or malposition of the fœtus, or other obstructive complication. This postulate is not always easy to obtain; and error or miscalculation may entail serious, even fatal, consequences. This is one objection to ergot. There are many others. The case, once entrusted to ergot, is likely to be beyond our control. We have evoked a brutal power like that given to Frankenstein. Ergotism, like strychnism, will run its source. its course. If it act too long or too violently, you cannot help it. You may try epichontocics, as chloral, nitrite of amyl, or physostigma, but these may fail. The ergotic contraction of the uterus when characteristically developed resembles tetanus. Then woe to the mother if any obstacle should delay the passage of the child. And woe to the child if it be not quickly born. The ergotic contraction does not observe the physiological character of alternating diastole, systole, and reposeeonditions necessary to the orderly circulation of the blood through the uterus, placenta, and fœtus.

Again, ergot may cause such vehement reflex straining that, the glottis being too long closed, rupture of air-vessels ensues, entailing emphysema of the neek, and perhaps extending widely. This we have seen several times. Another accident is the possibility of ergotic poisoning producing gangrene. This effect, well known in Germany from eating ergotised bread, is not unknown in obstetric practice. Dr. Begg relates a case ('Lancet,' 1870) of a young woman who took 65 grains of ergot during labour. Signs of extensive peripheral gangrene set in, ending in the amputation of both legs and arms, and, strange to say, survival. Lastly, McClintock and others contend that ergot exercises a direct toxical effect upon the fœtus. Quinia is open to less objection, but it caunot be depended upon.

If it be urged that accidents are exceptional and overdrawn,

and that innumerable cases may be opposed to them in which no injury could be traced, the reply is that these accidents have occurred, and that we cannot, when giving ergot, be sure that a catastrophe of the kind will not happen again. Should we not prefer to use weapons that will obey us, that will do as much, and not more than we desire?

There are such weapons, and, in competition with these, there is no excuse for resorting to ergot. There are means which, used singly or in combination, will rarely fail to accomplish what is wanted with all the precision, safety, and certainty that science can demand. Thus they differ from the brutal, intractable action of ergot: they admit of precise adaptation, in time and degree of force, to the peculiarities of the case in hand. Various means come successively and gradually into use according to the measure of the difficulty to be overcome. Thus, in the minor degrees of simple inertia, compression of the uterus by the hands, pushing the contents down in the axis of the pelvis, may suffice. We may sometimes succeed in exciting the uterus to contract by passing a flexible catheter or bougie into the uterus, so as to reach the fundus. It is an application of the labour-provoking agents to the acceleration of labour.

To overcome rigidity in the first stage several methods are described and practised. Chloroform is often of signal service. It acts by annulling the sense of pain, and by restoring the equilibrium of the nervous system, by removing disturbing influences that divert the nerve-force from its proper distribution; the sphincteric spasm relaxes, the body of the uterus contracts as it ought to do, and the labour proceeds. Tincture of opium or Hoffman's anodyne in half-drachm doses, separately or combined, are almost equally efficacious. Chloral is sometimes superior to opium. It produces unconsciousness without stopping uterine contractions. It may be given in fifteengrain doses every fifteen minutes, until the desired action is observed. But this caution we insist upon: not to exceed four doses. Another mode of giving chloral is to inject half a drachm into the rectum by enema.

Tartar emetic was at one time much used. It has occasionally answered our expectations; but we prefer means more certain and less distressing.

Bleeding is out of fashion. In this country few men are in a position to speak of its use in this connection from experience. We are among the few. In some cases of robust florid women, struggling strongly by reflex or semi-voluntary straining in aid of powerful uterine action, the abstraction of ten ounces of blood from the arm has been quickly followed by complete relief. The rigid cervix expanded easily, and possibly effusions were avoided. But the cases where it is wise to resort to venesection are rare.

Warm baths might be useful; but the inconvenience attending their use puts them out of the list of available remedies. The best method of using hot water is by vaginal irrigation. A stream of hot water is kept up for a few minutes, taking care that the tube does not enter the cervix uteri.

The most certain of all methods is water-pressure applied by means of Barnes's hydrostatic bags. By this means, not only is the natural force which expands the cervix closely imitated, but the diastaltic function is roused, and healthy, orderly uterine contraction is excited, if there be the proper reserve of nervous energy. If this fail, then we put on the $vis \, a$ fronte by the forceps. There is no violence; all the physiological requirements are respected. We help Nature after her own dictates, and exactly to the measure of her need. In some cases, in which the second stage of labour is somewhat advanced, the cervix may sometimes be dilated by the hand. Two or three fingers are insinuated within the os, so as to form a three fingers are insinuated within the os, so as to form a conical wedge. This wedge is gently and gradually pushed forward into the cervix, and, widening as it goes, the cervix yields. This wedge has the advantage of being a sentient force. It tells you what it is doing, and conveys information as to how you should proceed. Sometimes, indeed, you learn this: the fingers with their hard joints make a painful and irritating wedge. As it proceeds, it is apt to renew the spasmodic contractions we have taken pains to allay. If the head is pressing upon the cervix, it may be useful to help the dilatation by hooking down the anterior lip with one or two fingers, holding the os open, as it were, to allow the head to engage in it. But this application is limited. What is called manual dilatation of the spasmodic cervix should be abandoned, except dilatation of the spasmodic cervix should be abandoned, except in the case of spasmodic contraction after expulsion of the child

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—as, for example, when the placenta is retained, or clots are filling and irritating the uterus.

Water-pressure is the most natural, the safest, and the most effective agent. An os uteri that will admit one finger will admit No. 2 dilator in the collapsed state. The introduction is effected by inserting the point of the sound or any convenient stem into the little pouch at the end of the bag; the bag is then rolled round the stem, lubricated with a little soap, and—guided by the forefinger of the left hand—slipped into the cervix. Sometimes it is easier to seize the bag by a long speculum-forceps. When the bag is carried so far that the narrow or middle part is fairly embraced by the cervical ring



Fig. 67.—Showing application of water-dilator to dilate cervix uteri. (R. B.)

the sound is withdrawn. Water is then pumped in gradually, so as to distend the bag until it is felt tightly gripped by the os. Then wait a while; close the stop-cock, and give time for the distending eccentric force to wear out the resistance of the cervix (see fig. 67). No muscle can long resist a continuous force. From time to time inject a little more water so as to maintain and improve the gain. Care must be taken not to distend the bag beyond its strength lest it burst. This, we are told, has happened; we believe it need not happen if the bag is well made and properly used. When the dilatation is carried as far as No. 2 will do it, substitute No. 3, which

is larger and more powerful. The dilatation obtained by No. 3 is commonly enough to enable the forceps or the hand to pass. The time required for this dilatation may range from half an hour to two hours. It is desirable to keep the finger on the os, so as to be sure that the bag does not slip up into the uterus or down into the vagina; if it slip up, it may displace the head—in either case, time may be lost. When the due dilatation is attained, open the stop-cock; the water is ejected in a stream, and the bag is easily withdrawn.

The proceeding just described will succeed in the great majority of instances, especially where the closure of the cervix is due to spasmodic action, or where, the tissue of the cervix being normal, it cannot expand for want of an eccentric expanding force, as when the bag of membranes or the child does not bear fairly upon it.

But in certain cases, where there is alteration of tissue—as cedema, hypertrophy, cicatrix—something more is required: this is incision. This method has long been practised. Coutouly, Velpeau, Hohl, Scanzoni, and many other eminent men resorted to it. Judiciously employed, the knife can do no harm; it will save life where nothing else can. We are sometimes in the presence of the following alternatives: exhaustion, sloughing or rupture of the uterus on the one hand, or the timely use of the bistouri on the other.

There are various cases in which vaginal hysterotomy or dilatation of the cervix by incisions is necessary. First, no os uteri can be found; it may be closed by false membrane or atresia. Pressure with the finger or a sound will mostly break down a false membrane, and offer a sufficient opening to admit a hernia-knife. The forefinger of the left hand is kept on or in the os uteri as a guide (see fig. 68); the knife is then slipped up, lying flat upon this finger, until its cutting edge is within the os; this edge is then turned up, the back supported by the guiding finger, and an incision is made about a quarter of an inch deep in the sharp ridge of the os; the edge is then carried round to another part of the ring, and another nick is made. In this way four or five nicks may be effected. Each gives perhaps little, but the aggregate gain of these minute multiple incisions is considerable. We do not think it matters much at what points of the circumference of the os these incisions

are made; perhaps the two sides are to be preferred. Before extending or multiplying these incisions it is proper to observe the effect of uterine action in carrying out the dilatation. It is quite surprising to observe how rapidly and smoothly spontaneous dilatation sometimes takes place when these small incisions have taken off the morbid tension; it seems as if in a moment the due polarity and action of the uterine contractions, and the due relation between the factors of expulsion and resistance, were restored.

If the spontaneous dilatation fail, we turn to the hydrostatic



Fig. 68.—Showing mode of dilating cervix by incision. (R. B.)

dilator. This plan of combining water-pressure with small incisions is especially valuable in cases of rigidity from hypertrophy of the cervix or of atresia from cicatrix.

If it be found necessary to put on vis à fronte, the forceps, carefully used, may complete the dilatation. One blade is passed and the effect is watched; the second blade passed and the head grasped, the head is drawn steadily down, and by keeping up gentle traction the wedge formed by the blades and head will gradually dilate the os, perhaps enough to allow

the head to pass, and thus to save the child's life. But this must be done with great caution and delicate manipulation, and not be persevered in, unless the cervix yield readily. It is best to wait awhile, according to the condition of the patient.

It will occasionally happen that neither by incision, by water-pressure, the hand, or the forceps, can a sufficient opening be obtained without danger of laceration or other mischief.

In such a case it will be necessary to restore the equilibrium between expelling and resisting forces by reducing the head to the capacity of the cervix by perforation.

Narrowing and rigidity in the vagina must be treated on the same principles. The small rigid vagina of a primipara is best dilated by hot water irrigation and the larger-sized hydrostatic dilators, or Braun's colpeurynter. This plan will often shorten labour in a remarkable manner. Atresia from cicatrices presents a more formidable obstacle. The passage may be so constricted by dense cartilaginous tissue as to permit no more than a probe to pass. A careful process of incisions, multiplied in all points of the circumference, alternating with waterpressure, is necessary; and it is, after all, probable that the difficulty will have to be met half-way by perforating the head. In such a case the after-treatment is important. A lady, having been left many hours in labour, head in pelvis, was at last delivered easily by forceps; extensive sloughing of the vagina ensued, resulting in dense cicatricial closure. Again pregnant, we induced labour at five months, not daring to let pregnant, we induced labour at five months, not daring to let her run the risk of laceration or rupture that must have attended prolonged gestation. The labour had to be effected by incisions, water-pressure, and craniotomy. On her recovery we obtained and kept up a fair degree of dilatation by repeated incisions, bougies, water-pressure, and wearing pessaries, so that when again pregnant we were able to deliver, after dilatation by water-bags, a living child by forceps. In a subsequent labour she was delivered without operation in the country. This case is a happy illustration of the effect of chronic treatment upon cicatricial tissue. This tissue has but slender vitality; if kept on the stretch it often undergoes gradual vitality; if kept on the stretch it often undergoes gradual

Obstruction at the vulva and perincum must also be met on the same principles. In the ordinary case of tense, rigid

vulva and perinæum, we may first use free irrigation or fomentations with hot water; chloroform or nitrite of amyl may help by subduing voluntary expulsive effort. If the perinæum does not dilate it is very likely to burst, and if this begin we can hardly prevent it from running back through the sphincter ani; and if the perinæum does not yield, something else must. The uterus may cease to act, or, struggling in vain, it may burst itself or the vagina. In this way the rupture of the perinæum may be regarded as a conservative accident; it is the lesser evil. These dangers you may avoid by incisions. The forefinger is passed between the head and the edge of the vulva, and two or three small nicks are made on either side, nearer to the posterior commissure than to the anterior. The relief sometimes gained in this way is surprising. Spasm, irritation, and pain subside, the vulva dilates, and labour is soon happily The bleeding is insignificant, and the minute wounds left when the parts have contracted quickly heal.

It is a thing to remember that these minute incisions made at the os uteri and vulva are wounds no greater, often less, than those which Nature herself commonly inflicts in ordinary labour. They are but a small price to pay for the escape from wounds of uncertain, probably dangerons, extent.

Obstruction from serous infiltration of the labia must be met by multiple pricks or stabs with a lancet, or, if seen beforehand, by Southey's drainage-trocar needles. This proceeding is extremely important. If the swelling—which, in cases of albuminuria, is sometimes enormous—be not thus reduced, not only laceration but subsequent sloughing or gangrene may ensue.

A considerable number of cases are now recorded of obstruction to labour from the hymen. The treatment consists in incisions of the obstructing membrane and dilatation by the water-bags.

Obstruction by thrombus must also be met by puncture.

In cases of obstruction by tumours or cancerous growths otherwise insurmountable, recourse to the *ultima ratio*, the Cæsarian section, is indicated.

The Tumours that interfere with the Course of Labour.

These may be divided into two classes: tumours which are strictly uterine, and those external to the uterus and independent of it. The complication with tumours, in so far as gestation is concerned, has been studied in the chapter on 'Diseases of Gestation.' This forms a necessary introduction to the history of labour and puerpery complicated with tumours.

1. Uterine tumours. These, again, may be subdivided into: tumours which are imbedded in the uterine walls, mural tumours; those which project upon the outer surface, subperitoneal; and those which project into the uterine cavity, submucous or polypoid tumours. The complication of gestation with uterine tumours has been referred to in Vol. I., p. 336. We have now to study how these tumours affect labour, and how to meet the difficulties arising from this complication.

It may be stated in the first place that uterine tumours are more or less dangerous according to the position they occupy. Thus, subperitoneal tumours may entail no trouble in labour. Mural tumours or submucous tumours, if occupying the lower region—and which are, therefore, most exposed to injury during labour—are the most dangerous; whilst those seated in the fundus above the child are comparatively free from mechanical injury. They are not, however, altogether free from the danger of inflammation, and are not unlikely to cause hæmorrhage.

Closely allied to the muscular tumour in the uterine wall is the muscular polypus, which, attached by a stalk, projects into the uterine cavity, or through the os uteri into the vagina. Such a polypus may obstruct labour by getting out of the uterus before the head and blocking the vagina. A case of this kind occurred in St. Thomas's Hospital Maternity. A solid polypus as large as a full-sized cocoa-nut blocked the vagina. Dr. Gervis found that some laceration of the surface of the polypus had occurred, and that with every pain it became extremely tense and elastic. The child was delivered by craniotomy, and a second one by turning. The tumour after labour protruded through the vulva. It was removed by écraseur five days afterwards. The woman died on the thirteenth day. There

was peritonitis. The tumour was a myoma enveloped in a capsule of true uterine tissue; low necrotic inflammation was progressing in its substance. In St. Bartholomew's museum is a large polypus removed by excision, first discovered after labour. The woman recovered speedily. It is probable that the tumour was above the child during labour. This was the case in the late Dr. Crisp's case. The placenta being retained, Crisp introduced his hand and removed it. He thought he felt another child, but a large polypus was found, causing violent expulsive pains, greatly exhausting the patient. The violence of the pains forced the polypus so low down in the vagina as to interfere with the passage of the catheter. The patient died collapsed, worn out by the constant uterine spasm. There was no hæmorrhage. Violent uterine action has been observed in other cases, namely, in one related by Mr. Freeman, and in one by Dr. Pricstley.² Ingleby and Gooch relate fatal cases. In a case related by Beatty inversion of the uterus was produced by the tetanoid action set up by the tumour.

These cases are good illustrations of the issues when polypus complicates labour, and they indicate the rule of treatment. These issues may be summed up as follows: The tumour gets bruised and undergoes necrotic inflammation, leading to metroperitonitis and septicæmia; imperfect contraction may lead to hæmorrhage; uterine tenesmus or tetanus may cause collapse and exhaustion; the continuing expulsive action may lead to inversion of the uterus.

The treatment indicated, then, is, in the case of a polypus lying in front of the child, to remove the tumour by écraseur before the head is driven down upon it. The obstruction to the labour, violent action of the uterus, and injury of the tumour and the structures to which it is attached, are all obviated by this operation. When the polypus lies above the child, and only comes into evidence after the child is born, the indication is still to remove it by écraseur or galvanic wire cautery as soon as possible. The operation in either case is simple, and infinitely less dangerous than leaving the tumours.

If in some cases the changes induced in the tumour under

the influence of labour lead to the death of the patient, in others the labour acts in a happier manner—the tumour disappears. This may be brought about in at least two ways: First, myoma, being constituted of tissues analogous to those of the uterus in which it arises, grows with the uterus during gestation, and follows also the same law of involution after labour. In this way it is noticed that tumours, ascertained before gestation to be of a definite size, have grown considerably during gestation, and after labour have receded to their prægravid condition, no ill effect being observed during gestation, labour, or puerpery. In other cases, either by an exaggerated process of involution or by atrophy, the tumours have entirely vanished, leaving not a trace behind. We have seen such cases, one quite recently; the patient recovering after severe hæmorrhage and signs of septicæmia. Pagan relates a case. Leonard Sedgwick relates 1 two cases. Montgomery cites similar cases. Playfair relates 2 a case. There is yet another way in which labour may be said to cure or remove fibro-myomas: the crushing so injures their substance that they fall into disintegration by sloughing, and this process being limited to the tumour, it is cast out of its investing capsule, and is expelled by liquefaction in shreds or masses. This expulsion may be accomplished several weeks after labour. Robert Barnes exhibited to the Obstetrical Society a large tumour thus expelled. It seems that during labour loosening of the attachments takes place, favouring enucleation. Danyau and Matthews Duncan each relate a case in which partial enucleation thus effected was easily completed surgically.

The great decrease in size of the uterus and its persistent contractions tend to cast out the tumour.

The diagnosis of fibroid of the uterus complicating gestation and labour is sometimes difficult. If the tumour project on the outer surface of the uterus on the fundus—front or sides—the irregular prominence ensuing may make the diagnosis easy. But when the tumour is intra-mural or projects into the uterine cavity, especially in a region above the child, it may easily escape detection until after the labour. When the tumour grows in the lower segment of the uterus or in the cervix, it

¹ St. Thomas's Hosp. Reports, 1870. ² Obst. Trans., 1877.

comes more within the range of palpation. But the pelvis may be so blocked, the vagina and cervix so distorted, that access for the examining finger below may be impossible. The mystery may, however, be cleared up by making repeated examinations. The comparative observations may reveal changes of form, size, and relation. Auscultation may be expected to detect the feetal heart. But great caution is required, if a uterine rush only is heard, not to assume that it must be due to gestation; it may be produced by the tumour itself.

Tumours outside the uterus and pelvis may affect labour:
1. By pushing the uterus away from the pelvic axis, preventing the child from entering, or by causing malposition.
2. By impeding or disordering the expulsive forces.
3. Cysts may burst, causing shock and internal hæmorrhage or inflammation. The

principal of these are ovarian tumours.

We have seen (see p. 336, Vol. I.) that the ovarian tumour acted upon by the growing uterus may suppurate, burst, or become strangulated by rotating on its pedicle. Any one of these accidents may happen towards the end of gestation and during labour. This may occur even when the tumour has offered no material obstruction to the passage of the child. But where the tumour is lodged partly or wholly in the pelvis, unless it be movable, it can hardly escape injury, and by encroaching on the pelvic space it obstructs the passage of the child. Rupture is then more likely to happen; the dragging or stretching of the structures to which it is attached may set up pelvic and abdominal inflammation; and the bruising its own structures undergo may prove fatal.

It is well known that many women have gone through several labours without accident under complication with ovarian tumours. But this happy event can in no case be counted upon. Such immunity must be looked upon as a fortunate escape from imminent peril, and historics of this kind ought not to encourage a policy of expectation. Not a few women, after escaping once or oftener, have in the end fallen victims to one or other of the catastrophes recited.

Mr. Berry reports an extraordinary case, showing what narrow escapes sometimes occur. Labour had been obstructed

^{&#}x27; Obst. Trans., vol. viii.

by an ovarian tumour, and the child had been extracted with considerable force by forceps. Next day, after coughing, the patient felt something come down; this was found to be an ovarian tumour, the pedicle of which was traced through a rent in the upper part of the vagina. Mr. Berry thought the rent might have been caused by the forceps; but it is quite possible that in such a case rupture might occur spontaneously. A ligature was put on, and the tumour was cut off. The woman recovered. The preparation is in St. Bartholomew's museum. Luschka relates 1 a case of an ovarian tumour coming out through the vagina.

Dermoid cysts resemble in many features the ordinary cystic ovarian tumour. They more frequently occupy Douglas's pouch, and thus get below the uterus and child. They may feel so hard as to suggest solidity; but on puncture fat may run out, as in a case of Ramsbotham's,² in others related by Ingleby, and in a case of our own. Denman cites a case where labour was obstructed by a dermoid cyst between the vagina and rectum; the head was perforated, but the woman died from the injury inflicted upon the tumour and surrounding parts. In a case under Fancourt Barnes at the British Lyingin Hospital, the pelvis was nearly blocked by a dermoid cyst. After a protracted labour he performed the Cæsarian section after Porro's method. The woman died on the fifth day. The tumour was found inflamed.

The tumour formed by an ectopic gestation is one of the most remarkable and dangerous complications of labour. The danger of the cyst bursting during labour is very great, and if it does not burst it may become the centre of fatal inflammation. A case of recovery is related by Perfect; we cite it as a typical example. The woman had had one child, and thought she was pregnant again. At the end of nine months she had some pains, which went off, and the tumour grew less. A hard indolent tumour remained in the right side. Menstruation returned, she conceived again, and at the end of nine months she was delivered of a healthy child. The tumour was still felt as before. Five days later violent fever, purging, pain in the tumour, profuse feetid sweats set in. After nine weeks,

¹ Monatsschr. f. Geburtsk., 1867.

² Path. Trans., vol. iv.

fluctuation was manifest in the tumour; it was opened, a vast quantity of fætid matter escaped, and a fætus of common size was extracted through the incision. It was imagined that the placenta had dissolved into pus. The woman recovered and suckled. The issue was fortunate. Two cases are recorded by Greenhalgh. In one the tumour obstructed labour; it was pushed up with some force out of the pelvis, and the child was delivered by turning, dead. The woman died two days afterwards. A full-grown feetus, contained in its membranes unruptured, was found in the peritoneal cavity. Greenhalgh's second case is briefly as follows: A twin extra-uterine feetation obstructed labour; the forceps was applied to the uterine child. The woman recovered, with discharge of feetal bones. Montgomery collected several cases of women bearing uterine children, several times successively, an extra-uterine gestation persisting throughout.

A retro-uterine hamatocele may form a tumour obstructing labour. In a case seen by us, the mass of semi-solid blood was

expelled by the rectum.

Abdominal tumours may obstruct labour or entail dangerous consequences. Of these the principal are hydatid cystic disease of the liver, cystic disease of the kidney, and malignant tumours of the omentum. The dangers attending cystic disease of the liver and kidney, as bursting or inflammation, may be averted by tapping. This is best done by the aspirator-trocar.

The distended bladder may be carried down before the head, and present a tense fluctuating tumour at the vulva. The diagnosis and treatment of this complication offer no difficulty if the good obstetric rule of passing the catheter in every

case of tedious labour be observed.

Tumours in the vagina and vulva may offer great obstruction, but the cases are generally less serious because the tumours are more within reach of operative measures. Cystic or fibroid tumours may spring from any part of the vaginal wall; they are rare. At the vulva condylomatous or cancerous growths of large size may obstruct labour, and if not removed before the passage of the child may be so injured by crushing and tearing as to give rise to hæmorrhage, sloughing, and

¹ St. Bartholomew's Reports, 1865.

septiciemia. Such growths should be removed by the galvanic cautery or the écraseur. Bartholini's gland may be the seat of cystic degeneration or abscess. The tumour presents an oblong, tense, red mass varying in size from that of a pigeon's egg to that of a hen's egg. It should be laid freely open by the knife.

The diagnosis of ovarian tumours may be difficult when the complication first presents itself at the time of labour. In some eases, the presence of ovarian tumour will have been known before the pregnancy began. But it is remarkable that often no tumour is suspected until symptoms of distress set in at an advanced period of gestation, or even before labour. Then we are led to examine. The symptoms are mainly those which result from mechanical pressure. Dyspnœa, quickened pulse, hectic, accompany excessive abdominal tension. this may be due to excess of liquor amnii, to twin-pregnancy, to ascites. With care the two tumours, ovarian and gravid uterus, can generally be distinguished. The outlines of the two masses, ovarian and uterine, are more or less distinctly preserved. Even through the abdominal walls the groove between the two may be felt; it gives the idea of a bi-lobed tumour; the distension of the abdomen is greater transversely in the flanks than in simple pregnancy; and the fœtal heart is heard very much on one side, and generally lower than it should do. And we have observed that the spot of greatest intensity of sound shifts its place as the gestation advances, and as the uterus is pushed more and more aside. The os uteri will probably be pushed a little on one side, and a portion of the tumour may be felt in the brim of the pelvis. Twin-pregnancy may give some of the characters described, as greater breadth of abdomen, and a depression or groove at the summit of the uterus; but these are much less marked, and if we detect two fætal hearts the diagnosis is precise. A small ovarian tumour or an early tubal gestation may be diagnosed by the feeling a tense, elastic swelling in the roof of the pelvis, stretching the posterior wall of the vagina, and carrying the uterine neek forwards and the fundus to one side. The diagnosis is made clearer and a good therapeutical indication is fulfilled by puncturing the swelling by an aspirator-trocar.

The uterus deformed by myoma has been mistaken for a

uterus bicornis. Nor is the diagnosis easy even after the embryo has been expelled.

The treatment or management of gestation and labour complicated with ovarian tumours has been discussed so far as gestation is concerned. (See Vol. I., p. 303.) This, in fact, is the proper time to act. But the opportunity does not always present itself. The rule of conduct should be based upon the general law of giving primary consideration to the safety of the mother, regarding the fate of the child as of secondary importance. Indeed, a rigorous analysis will show that the best hope of rescuing the child will in many cases depend upon our success in saving the mother.

The fact which stands most prominently out, is that a main source of danger is the injury the tumour undergoes, especially during labour. The risk of bursting, of strangulation of the tumour, and of consequent shock, hæmorrhage, and peritonitis is so great, and the catastrophe comes with so little warning, that the question whether it is ever prudent to let gestation and ovarian tumour proceed together compels attention. do nothing because gestation and labour have been often carried through without mishap is simply trusting to chance. It is a surrender of judgment but too likely to entail unavailing regret. We have no means of foretelling whether or no a particular tumour will burst or become strangulated. The fluid tumours are more likely to burst; the more solid ones are liable to twisting, strangulation, and perforation. Both kinds may give rise to unexpected obstruction to labour, and undergo fatal injury during the process.

The point to which all reasoning converges is to reduce the case to its simplest expression by eliminating one or other of the complicating factors. Which shall we select for elimination? At one time we held that it was best to end the gestation by inducing labour, leaving the tumour for subsequent treatment. We are now convinced that it is best to eliminate the tumour. (See Vol. I., p. 334.) The question how to act, when labour is present or at hand, is more difficult of solution. We cannot lay down an absolute rule to govern all cases. If the tumour admit of removal without dangerous action upon the uterus, it is better, even during labour, to perform laparatomy and remove it. If sudden shock, with or

without severe collapse, indicating bursting or twisting of the tumour or rupture of the uterus, occur, it is, we think, imperative to lose no time before opening the abdomen, to discover the precise nature of the injury sustained, to remove the ovarian tumour, and, if the uterus have been injured, to consider the expediency of performing the Cæsarian section, simple or according to Porro's method.

In the next place we have to discuss how to act when labour is obstructed by tumour. Up to a certain point the principles of acting are the same, whether the tumour be ovarian or fibro-myoma.

The first question to determine is, Can the obstructing tumour be pushed out of the way? Many cases of ovarian tumour and some of fibro-myoma are movable, and admit of being lifted above the pelvic brim, so that the child can find room to pass. This may be done by the hand. The operation will sometimes be facilitated by placing the patient in the knee-elbow posture. Now and then the tumour rises out of the pelvis in the course of labour, under the unaided action of the descending uterus and child. Beatty and Depaul relate cases in point. In one case, Dr. Kidd, of Dublin, carried a tumour out of the way by distending a Barnes's bag below the tumour in the rectum. Sometimes considerable force is required. In the case of solid tumours, it may be necessary to pass the whole hand into the vagina or rectum, and to push firmly in the axis of the brim or in the line of least resistance. The pressure should be steady and sustained. In the case of cystic tumours containing fluid such pressure might burst the tumour. If then it does not rise out of the way under moderate pressure, we have to choose between two courses: First, to lessen the bulk of the tumour by tapping. The aspirator-trocar is the best instrument. Before tapping the tumour, it is advisable to rupture the membranes, and let the liquor amnii drain off. This diminishes the tension. The best place to puncture the cyst, if it protrude into the pelvis and fluctuation be felt there, will be the most prominent part of the tumour behind the os uteri in the vaginal roof, or by the rectum if the cyst be more accessible that way. But if fluctuation be not felt in the vagina, it is better to puncture in the most prominent part of the abdomen, after carefully

determining the position of the uterus by palpation and the seat of the feetal heart. A large aspirator needle should be used. The cyst, if punctured by the abdomen, will probably collapse more completely, and we are more likely to avoid the solid basis which is so often found at the lower part of ovarian tumours. When the tumour has collapsed, the labour may go on without difficulty, aided, perhaps, by forceps. There is, however, reason to fear that inflammation may be set up in the tumour or adjacent structures, and lead to danger in puerpery. In such an event the expediency of an exploratory incision, with a view to removal of the tumour, must be discussed. Secondly, if the tumour does not undergo sufficient shrinking under tapping to permit labour to go on safely, there should be no hesitation in opening the abdomen to remove the tumour; and if it cannot be removed, then delivery by Cæsarian section is the alternative.

Playfair has examined the question how to deal with ovarian tumours by comparing the histories of nearly fifty instances of labour complicated with ovarian tumour. He found that of the cases delivered by craniotomy more than half had terminated fatally. It might, he urges, be fairly assumed that, had the Cæsarian section been performed in these cases at an early period, the mortality of the mothers would not have been greater, whilst some of the children would have been saved. This reasoning is difficult to resist, but clearly it does not justify a uniform mode of procedure. The facts prove the extreme danger of dragging a child past a tumour, and that, in some cases at least, the Cæsarian section is the safer proceeding. When laparatomy has been performed with a view to Cæsarian section, it seems a reasonable thing to proceed to the extirpation of the tumour where practicable. Indeed, seeing that, sooner or later, an operation for removing the tumour must be undertaken, the opportunity of removing it at once should obviously be taken advantage of.

A third question arises, applying equally to the more solid ovarian tumours as well as to solid fibroids, if immovable and not reducible in bulk. The danger now rises. There is obstruction to labour; there is the almost unavoidable risk of injuring

¹ Obst. Trans., vol. vii.

the tumour. Malignant ovarian cysts may be firmly attached to the pelvic walls. Sarcomatous or bony tumours may spring from the pelvic walls, and fibroid tumours of the uterus may be impacted in the pelvis. Our decision as to the course to be adopted must be governed by a careful survey of all the conditions of the particular case. It is assumed that we cannot act upon the tumour. The alternative is that we must act upon the child or upon the uterus. Should we determine not to try the Cæsarian section after Porro's method—that is, to remove the whole uterus, tumours and all we must proceed to embryotomy. The mode of action will depend upon the degree to which the pelvis is contracted, and upon the estimate we may form of the nature of the tumour, and its liability to be injured by the passage of the child. If there remain three inches, or perhaps less, of space in the conjugate diameter, and the tumour be of a yielding substance, we may possibly deliver by forceps or by turning. If the space be very small, say under two inches, and the probability of the tumour being seriously crushed is great, we must be prepared to perforate the child's head to lessen its bulk and solidity. A perforated head will flatten and mould itself in its passage, especially under the cephalotribe; thus plastic and yielding, pressure against the tumour is greatly lessened.

In the case of a solid or comparatively firm tumour, leaving barely an inch or so of pelvic space, it may be difficult to reach the head to perforate; or, if perforation be accomplished, it may be impossible to pursue the further step of crushing the head by the cephalotribe, or of diminishing its bulk by allied operations. This is especially a case where lamination of the head by the wire-écraseur, as proposed by Robert Barnes, or by Tarnier's operation, promises to be useful. If we arrive at the conclusion that no amount of mutilation of the child that can be effected will ensure delivery with a reasonable prospect of saving the mother, then we should spare the child and deliver it by the Cæsarian section. Great as is the peril to the mother of this operation, there comes a point at which it holds out the best chance. And to give the best chance we should endeavour to perform the operation as the first step-that is, by election-without having previously damaged the prospect of success by fruitless efforts to deliver by other means.

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If the obstructing tumour be extra-uterine, bony or semi-solid, and encroaching to an extreme degree upon the pelvic space, the argument for Cæsarian section will be strengthened. If the tumour be uterinc-fibroid, the Cæsarian section must be carried out to the removal of the uterus after Porro's method. Dr. E. J. Lambert ¹ collected fifteen cases in which the Cæsarian section, simple, was performed. Two women recovered: one operated upon by Mayor, of Geneva, and one by Duclos, whose case is cited by Tamier.

When labour is obstructed by an extra-uterine gestation, the case more especially calls for laparatomy, and that for a double motive: first, to deliver the uterine child; secondly, to remove the extra-uterine child. Extra-uterine gestation-sacs so commonly contract adhesions with surrounding organs, that little can be expected from attempts to push them out of the way. We are, therefore, more disposed than in almost any other complication to resort to laparatomy.

In the case of solid tumours the question of tapping, except for diagnostic purposes, will hardly arise. The rule in dealing with solid tumours may be stated generally as follows: Push them up and aside, if possible, unless you see your way clearly to remove them aitogether. To enucleate a fibroid tumour from the uterus during labour is a hazardous undertaking, but circumstances may occasionally be favourable. Braxton Hicks relates ² a case in which, finding the head arrested by a firm tumour so filling the vagina that delivery by forceps, turning, or embryotomy seemed doubtful, he made a small incision in the lower part of the tumour, which, under distension, permitted its enucleation and removal. There was no bleeding. The woman did well.

What is best to do in the case of a myoma in utero after labour? If it have been seated at the fundus, especially if projecting under the peritoneum, it may have escaped injury, and there may be no indication for treatment. But if the tumour have projected into the cavity of the uterus at its lower part, it will be likely to have suffered injury, leading to inflammation or gangrene. The uterus, still in a state of active muscular development and reflex irritability, resents the presence of the

L'Études sur les grossesses compliquées de myomes utérins, 1870.

² Obst. Trans., 1870.

tumour as a foreign body. The expulsive pains set up are so severe as to be a source of danger; this we have seen strikingly marked. Cases in which spontaneous enucleation has been effected soon after labour have done well; cases left to nature have set up a low form of metroperitonitis, and have ended fatally. The indication, then, is strong to get rid of the tumour early. The mode of proceeding must be determined by the characters of the case in hand. The cervix, if closed, should be well dilated by a faggot of laminaria-tents; then a hernia, or other convenient knife, carried into the uterus, may be used to divide the capsule of the tumour freely. If the tumour project much into the uterine cavity, it may then be possible to shell it out, partly by the fingers and partly by Museux's vulsellum. Robert Barnes's axis-traction tumour-forceps has an excellent application here. If the tumour do not project much, and immediate enucleation be too difficult, further proceedings may be postponed. The uterus, continuing to contract, may drive the tumour further into the cavity, and in a day or two ts removal may be easier. This process and other indications will be materially promoted by subcutaneous injections of ergotine. Hæmorrhage, if it occur, may be checked by injeccions of hot water, supplemented, if need be, by perchloride of ron. Fector may be obviated by frequent injections of carpolised water or a solution of bichloride of mercury.

Summary of the Rules of Management of Labour complicated with Tumours.

Rising from the simplest cases to those of extremest difficulty, the general principles of practice are as follows:—

- A. Tumours complicating gestation. If the tumour, be it ovarian or uterine, encroach seriously upon the pelvic space, nterfering with the due development of the uterus and threatening to obstruct labour: 1. Provoke abortion or premature abour. 2. If the tumour be ovarian, as a general rule, remove t. 3. If it burst or become strangulated, the rule to remove t is almost absolute.
- B. Tumours obstructing labour—that is, presenting in front of the child: 1. Push the tumour above and aside if possible.
 2. If the tumour be fluid, and it be thought better not to

attempt its removal, tap it by aspirator-trocar. 3. If solid, puncture by aspirator-trocar, and if still not diminished in bulk, remove it if possible by enucleation or by écraseur. 4. If the tumour cannot be advantageously acted upon, reduce the bulk of the child. Turn, perforate, crush the head by cephalotribe, reduce by lamination. 5. If neither tumour nor child can be advantageously acted upon per vaginam, resort to the Cæsarian section.

C. When the tunours present after the birth of the child:

1. If polypoid, remove as soon as possible after labour by wireécraseur or galvanic cautery wire.

2. If sessile or projecting
from the inner surface of the uterus, more especially if seated
in the cervix or lower zone of the uterus, remove if possible by
enucleation.

3. If they cannot be so removed, try to promote
expulsion by quinia, ergotine, and watch to counteract septicæmia.

Prolapsus or procidentia of the uterus as a cause of dystocia. The uterus has been described as entirely procident outside the vulva during labour, at the natural term of gestation. To accomplish labour in such a case expulsion must depend upon the innate energy of the uterus itself. Complete procidentia in advanced pregnancy must be extremely rare. We may admit the possibility of the prolapsed uterus low in the pelvis becoming pregnant. There are no doubt cases of apparent procidentia uteri in which pregnancy has occurred. But we are not aware of any case in which it has been clearly demonstrated that the entire gravid uterus was suspended outside the pelvis and vulva. It has been said that the entire uterus containing the child has been driven through the vulva.

A curious case, which comes under this head, is cited by Moreau ¹ from Chopart. A young woman had procidentia uteri, the result of violence before marriage. This was never reduced; but after twenty years, the cervix becoming gradually opened, conception took place. Labour at term went on for twenty-four hours without progress, when the child was dead, and the woman seemed expiring. The surgeon, Marrigue, divided the cervix by incision and extracted the child. The woman recovered. There is a figure in Sicbold's 'Journal für

¹ Traité pratique des Accouchements, 1838.

Geburtshülfe,' 1826, of a large mass outside the vulva with a foot projecting, but it is not certain that the whole uterus was outside. A more probable case is that of Portal, treated in conjunction with the first Moreau. A primipara had long suffered from prolapsus, but the uterus had gone up during pregnancy, and only came outside under violent straining in aid of slight labour-pains. The orifice was artificially dilated and a living child was extracted. Harvey relates a case of conception taking place in a procident uterus; a dead premature child was expelled.

The treatment. Labour with simple prolapse is generally tedious, from the fundus wanting the full support and impact of the abdominal muscles. If the eervix be slow in dilating and the expulsive power be deficient, the cervix should be dilated artificially by the water-bags, and the forceps put on the head, care being taken to support the perinæum and vulva well, lest the lower segment of the uterus be drawn through. In the case of complete procidentia—if such a case occur the difficulty is aggravated; the uterus is away from all its auxiliary forces. Still its inherent power may possibly expel its contents. We should first endeavour to earry the uterus back into the pelvis. If this fail, delivery must be effected outside the pelvis. Whether the uterus aet by itself, or it be found necessary to extract the child by forceps or turning, it is desirable to support the lower segment carefully by means of a square cloth, having a hole cut in the middle large enough to afford exit to the child. This opening is applied over the os uteri, and the four corners are held up around the uterus, so as to eounteract the downward traction applied to the ehild. Scanzoni says the long continued bruising of the uterine walls against the pelvis may eause metritis or sloughing.

We have not seen a complete procidentia of the gravid uterus at term, but we have several times been ealled to see it. This is what we aetually saw: an enormous fleshy mass protruded beyond the vulva, of livid colour, and presenting an opening—the os uteri—in its centre. On feeling the abdomen we have found at least a portion of the uterus, containing part of the fœtus, there. It was clear, then, that, although the os uteri and cervix might be completely outside the vulva, the whole uterus was not. In one case, in which the midwife

said the labour-pains 'were forcing the woman's body out,' we found the os uteri outside; and the finger passed three inehes up along the eervical canal till it was arrested by the os internum uteri, upon which the child's head rested. This condition is represented in fig. 69.

Hypertrophic elongation of the cervix uteri was the real condition in the cases just referred to. It simulates closely complete procidentia on first appearance. In a subsequent labour the ease sketched came under Dr. Roper. He found the same condition. The elongated cervix, then, was a persistent condition. In another case we found the head had passed along the hypertrophied cervix, and was protruding the os externum outside the vulva. In another the hypertrophied eervix was enormously distended with extravasated blood-eervical thrombus or hæmatoma—a condition to which the hypertrophied cervix is especially exposed. One cause of dystocia in these cases is the hardened state of the os and cervix uteri. Another case under our observation illustrates the influeuee of labour upon the hypertrophied cervix. A primipara, aged twenty-two, was in labour. The cervix protruded through the vulva about three inches, forming a wass equal to a man's wrist in circumference. After reducing the cervix within the vagina the head could be felt. The cervix had a hard, gristly feel. Free incisions in the os externum were made, so that the os externum was freely opened up to meet the natural expansion of the os internum. She was then delivered after au anxious labour of fifty-two hours. Two months after labour the cervix was found hanging down in the vagina like a piece of shrivelled skiu. It was amputated. In dealing with cases of this kiud, it is advisable to wait until expansion takes place above, that is, at the os internum, and then meeting this by incisions or mechanical dilatation from below. The complication is fairly represented in fig. 69, designed from clinical observation.

Robert Barnes described and figured an interesting case in the 'Obstetrical Transactious,' 1876. The case occurred in the maternity of St. George's Hospital. A pluripara presented herself, when in the eighth month of gestation, with what she described as 'protrusion of the womb.' This had been gradually increasing for some months, causing much pain and bearingdown. The os externum was at least four juches outside the

vulva; the cervix was greatly hypertrophied and the vagina everted. The protruding mass was reduced, and the parts remained in situ until and during labour, which was six weeks before term. The labour was quick, with no complication. She died on the seventh day, under signs of toxemia. The cervix was elongated about 3.50 inches and much hypertrophied.

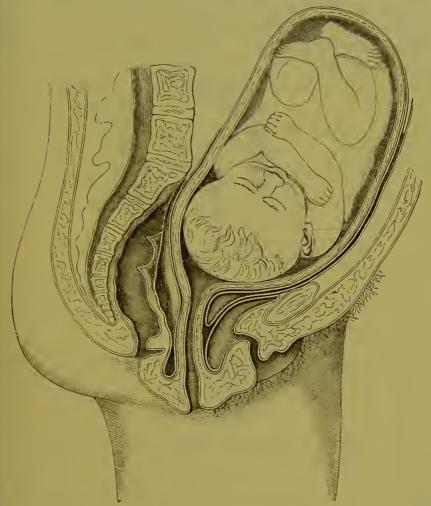


Fig. 69.—Illustrating Labour with Hypertrophic Elongation of the Cervix. (R. B.)

The head rests upon the os internum. The os externum is outside the vulva. The figure also shows the down-dragging and distortion of the bladder.

There was a broad ring of ecchymosed tissue at the juncture of the cervix and the body of the uterus. There was metritis and metro-phlebitis.

Pregnancy in compartment of a two-horned uterus is a rare and, therefore, perplexing complication. Robert Barnes

was called to a severe case of convulsions with albuminuria. There had been strong pains but no progress. Mr. Garlick, who was in attendance, could touch the presenting head; but Barnes felt a dense fleshy septum between the finger and the head, although it was clear that the finger passed into the os uteri. At last, following the clue given by Mr. Garlick, we also felt the head directly. It was thus ascertained that there were two ora uteri, each leading to a distinct uterine cavity, one of which contained the fœtus, the other being empty. It was

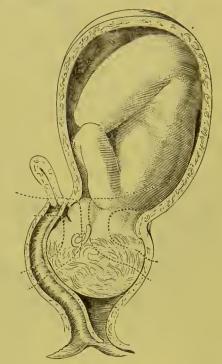


Fig. 70.—Representing Gestation in one Uterus, a second Uterus by the side Unimpregnated. (After Oldham.)

necessary to deliver by craniotomy. Oldham describes a similar case. Fig. 70 is taken from his illustration. Lefort cites a case from F. Tiedmann, who says there is in the Heidelberg Museum a double uterus with double vagina, taken from a woman who died after labour. At her labour two distinguished physicians attended; one declared the woman was not pregnant, the other that the head was in the os uteri. One had explored the right vagina, the other the left. The same

¹ Guy's Hospital Reports. ² Journ. Complém. du Dictionnaire, t. iv.

thing happened to two midwives at the Maternité, in 1824. The difficulty encountered by us, in the case narrated above, is therefore not without precedent.

Birnbaum relates 'a case of twin-pregnancy, there being a fartus in each side of a two-horned uterus. A very distinct saddle-like depression was observed near the umbilicus, the upper boundary between the two horns of the uterus. The summits of these rose to unequal heights. There was one placenta. He relates also a case of single gestation in one horn of a two-horned uterus. There is a valuable collection of cases illustrating this subject in 'Kussmaul.' (See also Barnes's 'Diseases of Women.')

In some cases the septum is continued all the way down the vagina. There is then a double vagina as well as a double uterus (see fig. 70). One vagina only is generally used in copulation. If labour be obstructed by such a septum, it should be divided longitudinally with a hernia-knife.

2. Dystocia from Faults in the Bony Canal.

Description of the Deformities of the Pelvis.

Deformities of the pelvis are mostly the result of disease or injury.

Stein, the younger, expounded the law that, like causative diseases produce like forms of pelvis. This fundamental proposition should be borne in mind when studying the different types of pelvic deformity. The origin and history of the development of the deformities observed are distinctly different, each type having its special origin and history.

Standing between the spinal column and the legs, the pelvis is subject to modifications imparted from each and both of these connected parts of the skeleton. It will bear the impress of faults existing in these parts in addition to the faults proper to its own structure. It may even be said that the derived deformities of the pelvis are the more numerous and important.

The principal types of pelvic deformity are: (1) The rickety pelvis; (2) the osteomalacie; (3) the kyphotic; (4) the funnel-shaped; (5, 6) the large and the small pelvis = pelvis

¹ Monatsschr. für Geburtsk., 1863.

æquabiliter justo major and the pelvis justo minor; (7) the oblique-ovate of Naegelé; (8) the thorny pelvis = acanthopelys of Kilian.

Then there are distortions or obstructions due to bony, fibrous, or sarcomatous outgrowths from the pelvic walls, and distortions from fractures.

As, in the case of normal labour, it has been too much the habit to overlook the part played by the lumbar part of the spinal column, concentrating attention upon the pelvis, so it has been, although in a less degree, with difficult labour, too closely associated with pelvic deformity. There is no form of pelvic deformity in which we can afford to overlook the associated spinal condition. In some cases, indeed in many, of rickets, ostcomalacia, spondylolisthesis, the spinal distortion is not only an important factor in combination with the pelvic distortion as causing dystocia, but it is an all-important factor in producing the pelvic distortion. There is, in fact, a form of lumbar or spinal distortion special to each typical form of pelvic distortion.

The truest and most instructive course is to describe the distortions according to the diseases which produce them. Thus, we should describe the distortions from rickets, the distortions from osteomalacia, the distortions from spondylolisthesis, those from syphilis and scrofula, not limiting the description to the changes wrought in the pelvis, but extending it to include the changes observed in the spinal column.

Barbour reminds us that, in studying the changes in the pelvis associated with the abnormally curved spine, we must take into account whether the pelvis itself is normal or diseased, since a deformity of the spine will produce different effects accordingly.

A. 1. We begin with the rickety distortions. These are of the most frequent clinical interest. Rickets, being essentially a disease of infancy, affects not alone the shape of the spinal column and pelvis, but also their development. Hence it is that the rickety spine and pelvis are commonly smaller in all their proportions, as well as deformed. This double abnormity intensifies the evils which flow from each separately.

The spinal deformities from rickets are two: lordosis, or arching forward, and, less frequently, scoliosis, or lateral curva-

ture. The common effect of lordosis is to carry the sacral promontory forward, so as to lessen the conjugate diameter of the pelvis. The lordosis involves the upper sacral vertebræ. Thus the brim of the pelvis is narrowed in two ways: first, by the overhanging lumbar vertebræ; secondly, by the projection forward of the lower lumbar vertebræ and upper sacral vertebræ. This is designated by Robert Barnes the 'false promontory.' It alters the normal lumbo-sacral curve, or Barnes's curve, into the 'curve of the false promontory' (see fig. 73, p. 562).

This lordosis is sometimes so great that it constitutes of itself an effectual barrier to the entry of the uterus and fœtus into the pelvis. When this occurs, the protrusion forwards of the uterus causes extreme prominence and overhanging of the belly. The effect is to throw the axis of the uterus and fœtus into extreme divergence from the axis of the pelvic brim.



Fig. 71.—Showing relative Shapes and Dimensions of Normal and Rickety Pelves.

There is a remarkable example of this deformity in St. George's Museum. The woman died after craniotomy.

The influence of lordosis upon the pelvis is to narrow the conjugate diameter, to flatten the brim, and to produce relative expansions or loops on either side of the pelvis. The general shape, as compared with the normal brim, is seen in fig. 71. This form of pelvis may be called the 'lordotic pelvis.'

When scoliosis occurs there is often oblique distortion of the brim as well as flattening. A perpendicular drawn from the symphysis pubis will strike on one side of the promontory. Double or compensated scoliosis sometimes is not attended by pelvic deformity.

Rickets occurring in earliest infancy, before the component

parts of the innominate bones have become fused, may lead to the triangular or trefoil deformity, somewhat resembling that produced by osteomalacia. Indeed, Hohl contends that rickets and osteomalacia are the same disease. There is a tendency, as development proceeds, to gain the normal shape. Hence we rarely find in the adult rickety pelvis a well-marked triangular deformity.

Fig. 72 is an extreme example of rachitic pelvis. The specimen comes from a dwarf upon whom Robert Barnes performed Cæsarian section after fruitless attempts at embryotomy, and irremediable injury had been inflicted. The pelvis is in St. Thomas's Museum. The specimen shows the tendency of

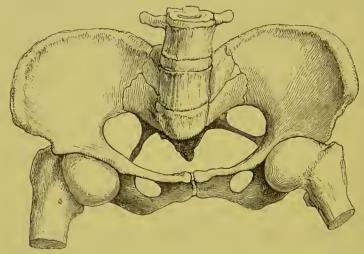


Fig. 72.—Rickety Pelvis, showing Contraction of the Conjugate Diameter or the Flat Pelvic Brim and Expansion of the Outlet. (After Barnes.)

this deformity to divide the brim into two parts, one on either side of the projecting promontory, so that the available space is reduced to one of the loops of the figure ∞ .

Deformities and contractions from rickets vary greatly in degree. The 'simple flat rachitic pelvis' of Litzmann, the most common form, is often said to have its transverse diameter absolutely lengthened. In some specimens the basis of the sacrum actually exceeds the normal width. Our own observations lead us to believe that actual excess of transverse diameter is rare. The transverse diameter is only relatively excessive. Thus, if we take, as is nearly always the case, the relation of the transverse diameter to the conjugate in the

standard pelvis to be nearly as 9:7, we shall find the transverse diameter of the rickety pelvis in most cases not to exceed 8, and the relation of this to the conjugate will vary from 8:1, 8:2, 8:3, or 8:4. Contraction may be said to begin at 10 centimètres, or 4 inches.

The rickety pelvis, as we have seen, is small generally; the narrowing bearing principally upon the conjugate, but affecting in less degree the other diameter also. Hicks has arrived at a similar conclusion. He has supplied us with measurements of ten rickety pelves in Guy's Museum. In two only of these does the transverse diameter measure 5 inches. That is the ordinary dimension; whilst four measure 4.75 inches, three 4.50 inches, and one 4.25 inches only. The pelvis, as a whole, is lighter. The bones are rigid.

It is quite probable that deformities vary in kind and degree in different countries, as they certainly vary in frequency. In England the poorer classes are better fed, clothed, and housed than in most countries on the Continent, and the general hygienic condition is superior. In some districts on the Rhine and around Milan osteomalacia is a frequent result of the miserable conditions under which the labouring classes exist; whilst in England the disease is so rare that many men in large practice have never seen a case. On the Continent rachitis also seems far more frequent than with us.¹

¹ This will account for the richness of the literature upon the narrow pelvis produced by our German brethren, and the meagreness of our own. It is the best answer that ean be pleaded against the reproach addressed to us by Spiegelberg. If we cannot vie with the German school in writings upon the subject, it is because they write from abounding materials, which with us are wanting. But have we not done better? We have largely prevented those diseases which lead to deformity. The frequency of narrow pelves in Germany may be estimated from the following data: Miehaelis and Litzmann found an average of 13 to 15 per eent., Schwartz between 22 and 23 per ecnt., Schroeder of 14.6 per cent., Spiegelberg about 14 per cent.; so that-eiting Spiegelberg-nearly every seventh pelvis must be stamped as contracted. These figures are mainly deduced from hospital records. And here again the Germans possess the great scientific advantage of enjoying numerous opportunities of pursuing and completing their clinical observations in the dead-house. If we eannot approach the figures attained in Germany in the number of narrow pelves, neither can we in the mortality in childbed. Before the introduction of the Factory Acts, limiting the age at which girls ean be employed in this country, deformed pelves were more common in our manufacturing towns. Radford informed us that within his

The influence of rickets is seen upon the innominate bones. They are generally smaller, thinner, sometimes diaphanous in the middle; and they are often flattened outwards, so that the crest of the ileum is straighter than in the standard pelvis.

The Germans recognise three principal forms of narrow pelves (see Litzmann and Spiegelberg): (1) The simple straight-narrowed or flat pelvis, the conjugate diameter being slightly shortened; (2) the uniformly contracted pelvis; and (3) a combination of the above, the generally-contracted flat pelvis. These have a special significance, so that it is of practical importance to distinguish them from the other and much rarer forms.

The simple flat pelvis is the most common. Two forms of flat pelvis are seen: first, the flat, non-rachitic pelvis. The flattening is caused by the pressing downwards and forwards of the sacrum between the innominate bones; in short, its transverse axis being rotated. Thus the inclination is not increased, and the diminution of the conjugate diameter is inconsiderable, rarely falling below 8 centimètres, or 3.50 inches. Secondly, there is the rickety flat pelvis, contracted in all its dimensions.

The effect of rickets upon the pelvis below the brim is variable. The cavity and outlet are in many cases apparently expanded. Not that there is absolute increase of room, but the relative dimensions compared with those of the brim are larger. This difference is due to the excess of pressure bearing upon the brim during development of the skeleton. There is often narrowing of the pubic arch, approximation of the tubera ischii, and sometimes incurving of the lower part of the sacrum and coccyx. Still, as a rule, in rickety pelvis the sacrum at the upper part is straightened, and forms a plane running backwards, and the bones at the outlet diverge.

Hence two things follow: First, obstruction is most marked at the brim; secondly, there is generally space enough at the outlet and in the cavity for the obstetric hand, and therefore for operations upon the child.

time deformities had become much rarer in Manchester, and he attributed this in a great measure to the operation of these Acts. The improvement of the physical conditions of the labouring classes, aimed at the prevention of deformities, offers a splendid field for the beneficent application of German science.

The rachitic distortion is rarely symmetrical. One side of the pelvis is commonly narrower than the other.

The triangular pelvis with contraction is associated with rickets and scoliosis.

Narrowing of the pubic arch is not uncommon. It is sometimes associated with kyphosis. By throwing the child's head backwards it is apt to cause laceration of the perinaum. It hinders the descent and rotation of the head, and often calls for the forceps. Another condition of the symphysis pubis is undue height. This carries the vulva and outlet of the pelvis so far backward as to be a great hindrance to coitus and to the progress of labour. The axis of the outlet is seriously deviated. This is not necessarily dependent upon rickets. The normal height is 4 centimètres, or 1.50 inch. Chantreuil measured one 7 centimètres, or 2.75 inches.

Diagnosis of the rickety pelvis. The aspect of the subject is often characteristic. There is dwarfing of stature, prominent belly. Rickets may be suspected from the low stature and ungraceful gait. It is often attended by marks of imperfect development, and by spinal deviation. The sacrum is remarkably flat externally. On internal examination the tubera ischii may be felt a little converging, so as to narrow the outlet; but sometimes nothing unusual may be noticed at this part, but on pressing the finger backwards, its tip strikes the sacrum or its promontory, whilst the knuckle is perhaps applied to the arch of the pubes. In a healthy pelvis this cannot be done. The value of pelvimetry has been referred to in Vol. I. No pelvimeter surpasses Van Huevel's. Its application is often of great scientific value. But we believe that in clinical work few surgeons of experience rely upon any instrument save the hand. This gives information that can be obtained in no other way. When there is obstruction, or retarded labour, or other cause to suspect pelvic contraction, the most practical course is to induce anæsthesia, and to pass the hand into the vagina. In this way we can explore the entire pelvis, take note of its various dimensions, and ascertain the relations of the fœtus.

In the minor degrees of rickety distortion, there may be no outward indication upon which to hazard a presumptive opinion. The difficulty comes before us at the moment of labour. Then, progress being obstructed, we search for the cause. We may then find flattening of the sacrum; external measurement between the lumbo-sacral joint, and the symphysis pubis may give less than 7 inches. The distance between the anterior superior spinons processes and that between the crests of the ilia may be less than normal. But here again the only safe method is internal exploration by the hand. If the finger easily touch the sacrnm or promontory, and if the head be felt resting upon the pelvis, its vault expanding above the points of contact on the brim, we may assume that there is contraction and disproportion.

The following circumstances should provoke the suspicion that there is pelvic deformity: A protracted first stage of labour; slow dilatation of the cervix; premature rupture of the membranes; an unduly transverse position of the head, the forehead being lower than the occiput; an abnormal presentation; failure of the presenting part to enter the pelvic cavity, although the cervix may be dilated; approach to a pendulous belly, the fundus uteri being lower than usual, pointing more forwards.

Pelvic deformity may generally be recognised by the characters it imposes on the course of labour. As a natural pelvis governs the process of labour according to certain definite laws, so do the various forms of abnormal pelves, each in its

own manner, control the process.

The mechanism of labour in rickety distortion will depend upon the degree of deformity. First, in the most extreme cases, in which the lumbar vertebræ hang over the pelvic brim, and the brim itself is narrowed to two inches or less in the conjugate diameter, the obstruction—always supposing a mature fœtus—is complete ab initio; the presenting part of the fœtus is simply shnt ont; it cannot enter the blocked pelvis. In this case there can hardly be said to be a mechanism of labour. Either the Cæsarian section must be resorted to, or the fœtus must be mutilated to bring it through the pelvis piecemcal.

In the case of the moderately contracted, flat, or rickety pelvis, the conjugate diameter being narrowed and the promontory projecting, the head can hardly enter the brim in an oblique diameter; it must almost necessarily present with its long diameter in relation with the long or transverse diameter of the pelvic brim. The anterior side of the head will, in the early stage of labour, overlap more or less, according to the

degree of contraction, the symphysis pubis. The broader expanse of the occiput, not so easily entering the pelvis as the narrower sinciput, is delayed a little on the edge of the brim; thus the forehead will be at first driven lowest in the pelvic cavity. The driving force increasing up to a certain point with the resistance, the head is gradually moulded by being flattened in its transverse or bi-parietal diameter, inducing great overlapping of the frontal and parietal bones, so as to adapt itself to the flattened brim of the pelvis. The projecting promontory changes the direction of the axis of the brim, depressing it so as to bring it nearer to the horizon—that is, it is made to form, with the horizontal datum-line, an angle less than 30°. The lower end of this false axial line would fall, not upon the coceyx, but higher up, at some point in the hollow of the sacrum, whilst the upper end would fall below the umbilions. There is increased inclination of the pelvis. The consequence of this is that the head must travel more directly backwards under the projecting promontory than when the pelvis is normal; it must, in fact, travel sharply round the promontory, doubling it in order to get into the pelvic cavity. The posterior side of the head is comparatively fixed against the promontory, whilst the anterior side of the head at first occupies nearly all the brim of the pelvis, the sagittal suture running across the brim and being much nearer the promontory than the symphysis pubis. In short, the asynclitism of normal relations is exaggerated in this form of abnormal labour. The head describes the first curve, 'the curve of the false promontory,' an exaggeration of Barnes's eurve. Having got so far, the occiput usually descends and eomes forward, and enters Carus's curve; this eurve, too, is sharpened. The resultant parturient curve of the rickety flat pelvis is strongly marked. The figure (73) shows the extent of the departure from the 'true parturient eurve'; how both are governed by VC, the vertebral curve; and how the inclination and axes are changed.

The head is delayed at the brim. Litzmann found that in normal pelves the head had entered the pelvis before labour in 70 per cent., whilst in narrow pelves the head had entered in 18 per cent. only; also that with normal pelvis the head got into the pelvis in 24 per cent. before the rupture of the

membranes, and with narrow pelvis the head descended into the pelvis in 56 per cent. after complete dilatation of the cervix.

Thus labour begins with a combination of unusual conditions.

One effect of the delay of the head upon the brim is that the lower segment or cervix of the uterus projects into the pelvis. Under uterine contractions, the head not being fixed, a larger quantity of liquor amnii is driven down, and the lower part of the ovum, filled with water and driven into the cervical canal, gradually stretches the cervix. This distending action is aided by the longitudinal shortening of the uterus. If the cervix be yielding, the bag of membranes unfolds it from above downwards in half-globular form; if the cervical canal offer

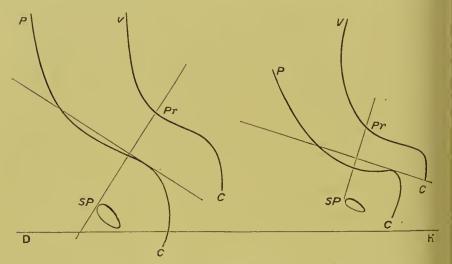


Fig. 73.—Showing the Comparison of the Sacro-Vertebral and Parturient Curves in Normal and Rachitic Pelves.

DH. Horizontal datum-line. SP. Symphysis pubis. Pr. Promoutory. VC. Vertebral curve. PC. Parturient curve.

more resistance, the fruit-sac, if its elasticity favour, is pressed down more or less in the form of a cylinder through the os uteri. Hence results frequent premature bursting of the membranes. This is due to the greater direct pressure of the uterine contractions upon the lower point of the fruit-sac. This is unfavourable to mother and child; a large quantity of liquor amnii escaping, the uterine and placental circulation is hindered, the head cannot expand the cervix quickly, and the orderly course of uterine action is prevented. There is unequal

pressure upon the cervical ring, it bears unduly upon certain points; hence bruising, perhaps more serious injury. Similar injury threatens the vagina. Not seldom the obstructed circulation in the cervix and vagina from undue pressure leads to swelling of the soft parts, adding to the difficulty.

If the contraction of the conjugate diameter be more pronounced—that is, to about 3.50 inches—the first stage of labour will be more protracted still; the presenting part will remain for a longer time above the brim; the os uteri, wanting the dilating force of the liquor amnii and head, will be more slow in opening; perhaps the cord will come down—and this is especially liable to occur if the membranes rupture early, since the head cannot block the brim. At length violent pains may force the head into the strait. The conditions already described will be observed in a more exaggerated degree. It is in these cases and in the preceding class that some additional force, applied à fronte by the forceps, is often valuable in economising and supplementing the struggling vis à tergo.

In the still more contracted conjugate, where it is reduced to 3 inches or a little less, the head can hardly enter at all; it rests upon the brim, touching at two or three points only, therefore perfectly movable, except when fixed by the driving power; and there it will long remain unless its bulk be reduced. In these cases a marked indentation, even fracture of the frontal or parietal bone, caused by the long and violent pressure against the projecting promontory, has been noticed. This injury is not necessarily fatal. It is useful to bear this in mind, because in the event of the forceps having been used this might be assigned as the cause. We have known actions for damages threatened on this ground, even although mother and child have done well.

Blood-effusion on the brain may be caused, and occasionally the child suffers facial paralysis in consequence of pressure.

The mother is obviously exposed to all the perils of protracted and obstructed labour—that is, to exhaustion, lesions of the uterus, vagina, and bladder, hæmorrhage, and puerperal disease. It is a generally recognised fact that in rachitic subjects successive labours become increasingly difficult. This fact is important to remember. Thus, a woman may be delivered of a live child without aid in her first labour, be

delivered with difficulty by forceps or turning in a second or third labour, and be delivered by craniotomy in a subsequent labour. Such a history might be unjustly cited as a reproach to the obstetrist whose lot it is to encounter the advanced deformity or increased size of the child.

The transversely contracted pelvis.

2. There are two forms: A. The two-sided synostotic, or double ankylotic, or Robert's pelvis. It is marked by narrowness of the sacrum, especially by the diminution of its wings, and ankylosis of both sacro-iliac joints. The sacrum is scarcely wider at the upper part than at the lower, and presents a long quadrangle. The whole sacrum is sunk deeply between the innominate bones, which rise above it behind; they are also stretched out forwards. The ischia approach each other and the edge of the sacrum; the transverse diameters are extremely contracted; the pelvis is generally somewhat symmetrical.

The most common cause consists in primary, congenital narrowness of the wings of the sacrum, either from inflammation attacking the already developed ilio-sacral joints leading to their ankylosis, or from defective development of these joints leading to synostosis. The prognosis is bad. Of eight cases six cases were delivered by Cæsarian section.

B. The kyphotic distortion. Spinal kyphosis induces a peculiar deformity of the pelvis, called by Breisky¹ and Hugenberger² the 'kyphotic transversely-contracted pelvis; by Michaelis, the 'transversely-contracted pelvis' ('das querverengte Becken'). Litzmann describes³ a case. The most recent contribution to the subject is Dr. Barbour's beautifully illustrated work on 'Spinal Deformity in relation to Obstetrics,' 1884. The illustration, fig. 74, is borrowed from Hugenberger.

This form of pelvis resembles the pelvis of the lower mammalia, of the human infant, of the Bushmen, and Malayans of Java. It is interesting to compare fig. 74 with the ideal scheme of the Andamancse pelvis (fig. 58, Vol. I.). The dimen-

¹ Med. Jahr. Wien, 1865. ² St. Petersburg, Med. Zeitung, 1868. ³ Die Formen des Becken, 1861.

sions of the brim are reversed, the antero-posterior diameter being lengthened, and the transverse shortened. These altered relations are made clear by reference to fig. 75.

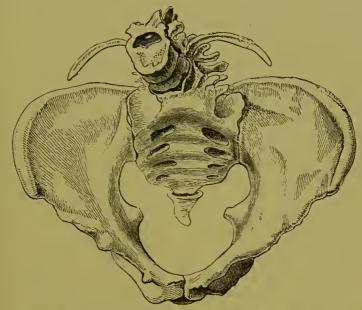


Fig. 74.—Kyphotic Pelvis, showing Lengthening of the Conjugate and Contraction of the Transverse Diameter. (After Hugenberger.)

The change of shape of the pelvis seems to be due to the kyphosis of the spine. The lumbar vertebræ retreating, arching backwards, carry the related upper sacral vertebræ

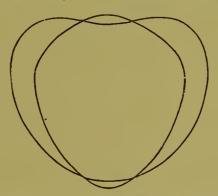


Fig. 75.—Showing Comparative Outlines of Brim of Standard and Kyphotic Pelvis.

back with them, thus effacing the promontory. It does not appear that this effacement increases the total capacity of the brim; the lengthening of the conjugate is gained at the expense of the transverse diameter. In a specimen in

St. Bartholomew's Museum we find the conjugate diameter is 5.25 inches, and that of the transverse 4.50 inches, nearly. In some Continental specimens the transverse narrowing is more marked than this. Where the disease begins before puberty, the development of the pelvis is arrested generally, the result being that the pelvis is small as well as distorted.

In one form the transverse diameter is not shortened, but the conjugate is much lengthened, as in a specimen in St. Thomas's Musuem. Barbour found 'the conjugate of the cavity increased, but to a less degree than at the brim. The sacrum is narrowed transversely and elongated vertically; its vertical curvature is diminished throughout. At the outlet the conjugate is not usually altered. The transverse may be contracted, and that to an extreme degree. The pubic arch is narrowed. Thus the true pelvis is funnel-shaped.'

The upper half of the sacrum is rotated backwards and upwards; the lower half forwards and inwards. The innominate bones rotate from below inwards to upwards and outwards on an axis drawn through the hip-joints perpendicularly to the drag of the ilio-femoral ligaments, so that, under the resistance which these bands undergo in opposition to the drag of the sacrum backwards, the upper half of the innominate bones is moved outwards and forwards, the lower half inwards and backwards. Hence the increase of the transverse diameter of the great pelvis, and the diminution of this diameter in the cavity, and especially at the outlet of the small pelvis. The tuberosities of the ischia and the spinous processes come nearer together, and the pubic arch is narrowed. The small pelvis becomes deeper.

In some cases, as in one by Stadfeldt, cited by Spiegelberg, a lordosis of the lumbar vertebræ attends the kyphosis, with the result of forming a roof to the pelvis, as in spondylolisthesis,

constituting the 'pelvis obtecta.'

The diagnosis is indicated by the stooping forwards of the body, the thighs projecting forwards, and by the recognition of the kyphosis. It is distinguished from other deformities, especially from the osteomalacic, by the great distance between the iliac spines, the flatness of the alæ of the innominate bones, and the difficulty in reaching the promontory.

The characters of the kyphotic pelvis are for the most part

the inverse of the typical rickety pelvis. Most of the diameters which rickets diminish, are increased in kyphosis. In rickets the sacrum is driven down under the weight of the trunk; it is not so high; it has turned round, so that its base is carried down and forwards in nutation, whilst its point turns upwards and backwards. In the kyphotic pelvis the sacrum is erected, its base being carried backwards and upwards. The sacro-vertebral articulation is much above the linea innominata. At the level of this line is found the upper part of the second sacral vertebra. This articulation presents a certain relief, the two bones forming it making a jutting angle forwards instead of receding as in the normal pelvis.

Labour is obstructed at the beginning. The normal relation between head and pelvis is reversed. The Cæsarian section has been found necessary, although delivery could, we imagine, almost always be effected by embryotomy. The induction of labour is indicated. Hugenberger and Phænomenhoff remark on the greater frequency of occipito-posterior positions. This was the position in Barbour's case. We have long noted the frequency of occipito-posterior positions in connection with the funnel-shaped pelvis and flattened promontory, conditions which are now shown to indicate kyphosis. Champneys analyses thirty-two cases. He says right occipito-iliac position is much commoner than the left.

The Osteomalacic Deformity.

3. Osteomalacia = mollities ossium. This disease, almost always arising after maturity, attacks bones fully developed. We saw, however, in the Munich Museum a specimen of intrauterine osteomalacia.

It produces a very remarkable deformity. This bears chiefly upon the spine and pelvis, the long bones being comparatively unaffected. The bones, losing their mineral constituents, become soft and yield under pressure. The pelvis and lumbar vertebræ, forming a compressible centre between the upper part of the body and the legs, give way; all the bones sink inwards, collapsing concentrically. The spine falls downwards and forwards, squatting, the subject losing notably in stature. In

¹ Obst. Trans., 1883.

many instances the lower lumbar vertebræ dip into the pelvic cavity. Specimens in St. Bartholomew's Museum and St. George's illustrate this in a striking manner. The heads of the femora drive in the acctabula and sides of the pelvis. In

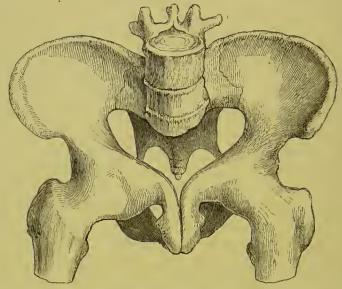


Fig. 76.—Osteomalacic Pelvis, showing the Beak-like shape of the Pubes. (R. B.)

some cases the ilia are doubled up, folding in like wet pasteboard. The pubic bones are flattened together by their posterior surfaces so as to form a beak or rostrum, so distinct that the finger and thumb can seize it through the living structures.

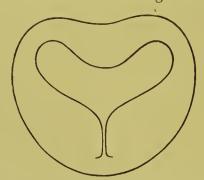


Fig. 77.—Showing Comparative Outlines of Brim of Standard and Osteomalacic Pelves.

The effect upon the brim is to produce the extreme cordate or trefoil shape, somewhat resembling the letter Y (see fig. 77). The cavity and outlet share the general concentric compression,

differing thus from the rickety distortion. There is really no pubic arch; the tubera isehii are closely approximated; the outlet is almost obliterated. The obstetric result is that in marked cases it is scarcely possible to introduce two fingers. There is little or no room for manipulation or for working instruments, so that we are commonly compelled to get at the feetus from above by the Cæsarian section.

The concentric compression is not always symmetrical. In the Strasburg Lying-in Hospital are specimens in which one side is much more driven in than the other. In the Radford Museum, Manchester, is a specimen in which the promontory or last lumbar vertebræ actually touch the innominate bone. To study osteomalacia on a large scale, one must visit the German museums. The disease is nearly extinct in England.

The disease occurs in men as well as in women, but rarely. In a large proportion of cases the disease has been started during pregnancy or puerpery, affording another striking example of the value of studying general pathology by the light of the physiology and pathology of gestation.

Once begun, it is pretty sure to be aggravated in succeeding gestations. It seems probable that lactation acts by the waste of calcareous matter through the milk. But it occurs independently of gestation, as in a striking case forming the basis of a memoir by Robert Barnes. It seems to be almost endemic in the rice-fields around Milan, and in other places where the poorer classes exist under every form of physical distress. But we have seen it developed in women in easy circumstances. It tells more especially upon the vertebræ and pelvis, the long bones escaping in great measure. Letheby examined the urine in Robert Barnes's case, and found 37 per 1,000 of solid matter, eonsisting of urea, extractive, and salts. There was a large excess of earthy phosphates. We found during the active stage of the disease a large excess of urea, of alkaline and earthy phosphates, and extractive, almost constantly a little sugar, and sometimes a little albumen.

The obstetric relations are especially interesting. One important feature that distinguishes the osteomalaeic pelvis from all other forms is its dilatability. Just as it undergoes concentric infolding by virtue of its softness, so it may be

¹ Med. Chir. Trans., 1862.

opened out again eccentrically under pressure from within. This property is occasionally turned to account in labour. Kilian discusses this point, and relates a strikingly instructive illustration. Ed. Von Siebold wrote him this history: Tr—— has long been burning with desire to perform the Cæsarian section. At length he thought he had a suitable case—a woman afflicted with osteomalacia. He invited his colleagues, amongst them Osiander, to the operation. The woman lay on the operating table, when Osiander begged permission to make an examination. He made it, and gradually passed in his whole hand, forcing the soft pelvic bones apart, turned the child, and brought it through living. He told

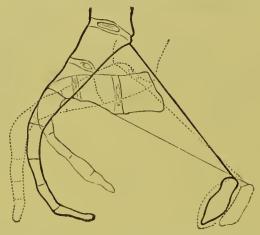


Fig. 78.—Shows Comparative Views in section of the Normal Pelvis (the strong line), the Osteomalacic Pelvis (the fine line), and the Rickety Pelvis (the dotted line).

Von Siebold next day, with tears of joy in his eyes, "Yesterday I saved a woman from Cæsarian section, and also from death." Kilian, Von Ritgen, Hall, Spengel, Litzmann, and Tyler Smith relate cases proving the same point. The late Professor Lazzati, of Milan, informed us that his experience was to the same effect. It may, then, be taken as a fact that the pelvis is sometimes dilatable enough to permit of delivery per vias naturales, and that this method demands trial before resorting to Cæsarian section or embryotomy.

It deserves to be borne in mind that osteomalacia may be arrested. Kilian says, 'That osteomalacia heals is beyond

¹ Das halisteretische Becken, 1857.

dispute, but whether it is ever *cured* is altogether doubtful.' Breslau and Litzmann give cases which recovered mainly under the use of cod-liver oil. Two cases under Robert Barnes recovered under the same remedy.

The funnel-shaped pelvis. The peculiarity of this distortion consists in the brim being of fair proportions, whilst the tuberosities of the ischia and the sacrum converge, narrowing the outlet. We have met examples of it amongst the weavers of Bethnal Green and others who from childhood spent a great part of their lives in a sitting posture. Imperfect nutrition, no doubt, disposes to it. It is frequently referred to by the Dublin School. A marked case came under our care, the subject being a lady who exhibited no other mark of having suffered in health. Her first two children had been sacrificed by craniotomy; in the third pregnancy labour was induced at seven months; the forceps brought the head without difficulty to the outlet, when the disproportion became too manifest to permit a hope of its passing in this way. We turned, and delivered a child which survived.

This history is a fair clinical illustration of the process of labour in the funnel-shaped pelvis. The head may engage in the pelvis and descend to the floor, where it gets arrested; rotation is impeded. After allowing fair time for moulding, aided by compression of the forceps, it is found that the head cannot pass. It must be lessened in bulk by craniotomy, if we find that it cannot be brought through after turning. The funnel-shaped pelvis is one of the features of kyphosis. The sacro-coccygeal joint may be ankylosed. This produces an effect similar to the funnel-shaped pelvis. In such a case we may have to choose between lessening the head and forcible fracture of the ankylosis, to allow the coccyx to revolve backwards.

$Spondy lolist hetic\ Distortions.$

4. Spondylolisthesis is the sliding down of the lumbar vertebræ upon the upper sacral vertebræ. This gliding down throws two or more lumbar vertebræ into the cavity of the pelvis, producing a new and false promontory in front of and lower than the true onc. It not only contracts the conjugate diameter, but, by partly filling the pelvic cavity, prevents the uterus and child from entering.

The figure is taken from Kilian, who first described the distortion. The pelvis is in the Prague Museum. In another specimen described by Kilian, the false conjugate starts from the second lumbar vertebra, the third, fourth, and fifth having all sunk into the pelvis. Since Kilian (1853) attracted attention to this distortion, several important memoirs have illustrated it. The most recent and interesting are those of Neugebauer (1884) and Swedelin (1884).

Franz Neugebauer eoncludes from a critical examination of

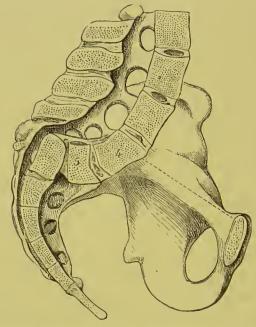


Fig. 79.—Spondylolisthetic Pelvis, showing Dislocation into the Pelvic Brim of the Lumbar Vertebra. The 'Prague Pelvis.' (After Kilian.)

4, fourth vertebra; 5, fifth lumbar vertebra.

all the known cases—namely, 17 museum specimens and 26 in living subjects—that 'the sliding of the vertebræ is a deformation always produced in extra-uterine life, without the intervention of any primitive dyscrasia or disease of the bones, inflammatory or specific (that is, it is not rachitic, osteomalacic, caries, or osteistis). It is produced by the physiological weight of the trunk acting under the influence of certain surgical predispositions, especially when this weight is augmented by overloading the body, by repeated pregnancies, &c.; and this

deformity is not limited to the sacro-lumbar articulation nor necessarily confined to age or sex.'

In most of the cases observed there is simply a sliding down of the anterior half of the fifth lumbar vertebra—that is, of the half of the vertebra upon which the fourth lumbar vertebra bears with its direct weight; the posterior half of the vertebra keeps its place. Thus the vertebra is lengthened by dragging upon the anterior half. This lengthening is well marked in some cases.

Dr. Neugebauer demonstrated his views to the Obstetrical Society in 1884. A committee, consisting of Neugebauer, William Adams, Noble Smith, A. Doran, and Robert Barnes, examined the specimens, and confirmed the accuracy of his conclusions. Neugebauer further discovered a characteristic specimen in the museum of University College. This specimen Dr. Graily Hewitt brought before the Society.

A case described by Robert Barnes 1 seemed to be caused by fracture. Neugebauer admits fracture as a possible cause.

Spondylolisthesis obstructs labour by encroaching on the pelvic cavity. According to the degree, it may compel resort to craniotomy or the Cæsarian section. In our own case we brought on labour prematurely.

- 5. Distortion from disease of the pelvic articulations.
- (a) The pelvis obliquè-ovata, or the 'schräg-verengtes Becken' of Naegelé. The illustration (fig. 80) is taken from Naegelé's classical work. It is a fair type; but there are various modifications of this distortion.

An essential condition of this pelvis is the loss of size or development of one side of the sacrum. In nearly all the cases the hip-bone of the defective side is pushed higher and backwards; in many cases the ilio-sacral joint of the affected side is ankylosed; there is one-sided synostosis. On the sound side the innominate bone is more strongly inclined, pushed outwards from the symphysis. The distortion is most marked at the brim.

The diagnosis is not difficult. The subjects are mostly deformed on one side. Measurements of the two sides of the pelvis will give different dimensions.

The effect upon labour is according to the degree of the

¹ Obst. Trans., 1865.

distortion. If marked, the head cannot follow its normal movements. Craniotomy may be necessary.

 (β) Another form of the obliquely-distorted polvis is that arising in young subjects having one leg shorter than the other, or ankylosis of one hip-joint. In such cases the lame side is less developed than the other side; the polvis is obliquely contracted; a perpendicular drawn from the promontory, which should represent the conjugate diameter, falls on one side of the symphysis. This distortion will disturb the relation between head and pelvis, and according to its degree necessitate forceps, turning, craniotomy.

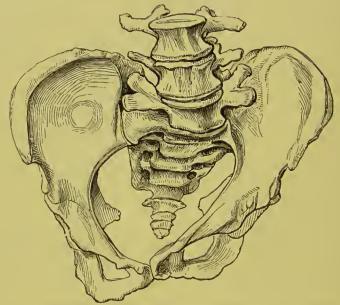


Fig. 80.—Obliquely Distorted Pelvis, or Naegelé's Pelvis. (Naegelé.)

The acanthopelys, or Stachelbecken of Kilian. This may be called the 'thorny pelvis.' Syphilitic, strumous, or rheumatic diseases may affect the bones of the pelvis, as they do the bones of the cranium and other parts. Sharp ridges or needle-like projections shoot up from the bones. The bones are also at times enlarged, spongy, thick, even distorted. The most frequent seat of these projections or outgrowths is the sacrum; but they may be found in any part. If ridges or spikes occur on the edge of the pelvic brim or on the symphysis, the uterus, forced down upon them, may be cut or stabbed in labour. We have seen a ridge formed on the linea ileo-pectinea so pro-

minent and sharp as to give a knife-like edge. Probably in the syphilitic cases evidence of disease may be found in other parts of the skeleton as well, thus helping to a diagnosis.

With the history of the various forms of pelvic deformity before us, we may usefully note Duncan's theory of the development of pelvic deviation. He says the sacrum does not act like the keystone of an arch; it forms a strong transverse beam, suspended by means of the sacro-iliac ligaments, between the two curved cotylo-sacral beams; the weight of the body acts as a force tending to draw the sacral ends of the cotylo-sacral beams downwards and inwards, which movement is counteracted by the upward and inward pressure of the heads of the femora (on the cotyloid ends of these beams), as well as by the tie-beam of the pubic bones.

This theory was adduced to explain the changes which the normal pelvis undergoes in passing from the infantile to the adult type, and also such abnormal types as the rickety and malacosteon. More recent researches have, however, shown that the peculiarities in form, which were attributed by Duncan and others to the weight of the body transmitted in the manner described above, may be present in the pelvis before birth. Fehling, who has studied specially the development of the normal pelvis, has demonstrated that the vertical curving of the sacrum, the transverse widening of the brim, the incurvation of the cotylo-sacral beams, are found already in the fœtal pelvis. The researches of Kehrer into the mode of origin of the rickety type of pelvis have shown that this abnormal form is sometimes developmental. With regard to the malacosteon alone, all investigators are agreed that the peculiarities of form are duc to the action of the weight of the trunk on the cotylosacral beams. The history of spondylolisthesis, in which the last lumbar vertebræ may be taken as the analogue of the sacrum in rickets, seems to tell against Duncan's theory.

Tumours growing from the pelvic walls may so encroach upon the pelvic space as to render the passage of the child difficult or impossible. These tumours may be bony exostoses, fibrous, sarcomatous, or cancerous. They most frequently spring from the sacrum. In the classical cases of Naegelé and Shekleton, one of which is copied into nearly every text-book, the pelvis was quite blocked. The labours of the woman

in Shekleton's case had become increasingly difficult as the tumour grew. This history enforces the indication to induce labour early enough to permit safe passage of the fœtus, and if the Cæsarian section is performed, to remove the uterus on Porro's method. We assisted Dr. Greenhalgh at St. Bartholomew's at a similar case. We could just feel a foot, but both failed to deliver. Mr. Skey performed Cæsarian section. The woman died. The pelvis was found filled by a sarcomatous tumour. In a case to which we were summoned to deliver by Cæsarian section, we succeeded in delivering after craniotomy. The woman recovered. The tumour did not grow in a marked manner, and we saw her occasionally at the London Hospital for some years afterwards.

Berry relates 1 an instructive case of obstruction from medullary cancer springing from the bones of the sacrum. As it felt fluctuating it was punctured. A large quantity of florid blood flowed. After great exertions the child was delivered after craniotomy and turning, but the woman died in an hour. The uterus and vagina were found lacerated.

The diagnosis is generally not difficult. The uterus and child are obstructed above the pelvis. Examination by vagina realises the blocked condition of the pelvic cavity; the vagina is compressed and distorted. By rectum the mass is more clearly defined; it is felt projecting the vaginal wall and closing

the passage.

In cases of marked obstruction from immovable tumours in the pelvis, clinical experience points to the Cæsarian section as an elective proceeding. It is true that this operation, itself surrounded by great peril, may, even if successful, only give the woman a short reprieve. But this prospect is better for her than the imminent danger of speedy death attending attempts to deliver *per vias naturales*. Then there is the probability of saving the child; and this should turn the scale in favour of the Cæsarian section.

Distortion from fracture. Under violence sustained before or during gestation the bones of the pelvis may be fractured, and undergo repair with more or less deformity. The parts most liable to fracture are the alæ of the ossa innominata. If limited to the upper or false pelvis, the course of gestation

and labour may not be seriously impeded. But if the framework of the true pelvis be broken, since it is almost impossible to secure accurate readjustment of the parts, distortion is most likely to ensue. This distortion must almost necessarily tell upon the cavity and brim of the pelvis, and thus cause an obstruction to labour.

The split pelvis. 'Das gespaltene Becken' of Litzmann. This is almost always associated with defective union of the abdominal walls and bladder. In Walter's case the symphysis was open, although the abdominal walls were united. The pelvis is flattened. A property of obstetric interest is that it is distensible.

Dystocia from the Fœtus.

A* Obstacles occurring with the Healthy Fœtus.

- (a) Anomalies of presentation and position. It will be enough in this place simply to indicate them. The clinical history will be told when describing the operations. The breech or trunk may present in such a way that labour will be obstructed.
- (b) The head may present with error of inclination, and there may occur faults in the movements of descent and rotation.
- (c) There may be association of one or more limbs with the presenting part—that is, a hand may come down with the head; or there may be nuchal displacement of an arm—that is, an arm may hitch behind the neck.
- (d) There may be excessive development of the fœtus in head, shoulders, or body. Several cases of children born alive at term weighing over 17 lbs., and even 20 lbs., are recorded. (See Neale's 'Digest,' and 'Lancet,' 1884, for one by Dr. Hodgson.) Ossification too much advanced may diminish plasticity.

The errors of position of the child may depend upon, or be associated with, errors of the other factors of labour, especially faulty pelvis.

(e) The umbilical cord may impede labour by being too short, or by getting twisted round the child's neck or body. In either ease the descent of the child may be impeded, it being tethered to the uterus.

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It is usual to class prolapsus of the cord under the head of dystocia. Strictly speaking, prolapsus of the cord cannot oppose a serious obstacle to labour, in so far as this means the passage of the child. But it endangers the child's life.

B. Obstacles from Pathological Conditions of the Fœtus.

The principal of these are hydroeephalus, hydrothorax, anasarea, aseites, distension of the bladder, emphysema, tumours on the surface of the body, deviations of the spinal cord, spina bifida, cystie or other enlargement of the liver or kidneys, ankylosis of the limbs, morbid attachment of the fœtus to the placenta or uterus.

Monsters not uncommonly cause dystocia.

Tumours on some part of the fœtus may present a serious and puzzling obstruction. Cystie tumours, the sac of a hydroraehis, eetopy of the intestines, parasitic tumours, as of a fœtus grafted upon some part. The cystic hygroma is most common on the saeral region. A remarkable example of saeral tumour is figured from a specimen in St. Thomas's Museum, in the 'Obstetric Operations.'

- C. Death or impending death of the fætus. In connection with this there may be emphysematous distension from putrefaction, or the rigor mortis may prevent the adaptations of the fœtus.
 - D. Head of feetus detached, and remaining in utero.
- E. Multiplicity of fætuses. (a) Fætuses being in separate saes, there may be wasted expelling force. (b) The fætuses may be in one sac and get in each other's way. There may arise entanglement of the limbs or other parts of the fætuses.
 - F. Ectopic gestation has been studied under 'Tumours.'
- G. Dystocia from faulty condition of the placenta. The complications arising from placenta prævia and other conditions have been described under 'Hæmorrhage.'

Clinical Classification of Cases of Dystocia.

The following distribution of the eases of dystocia according to their practical therapeutical indications will be found useful:—

1. Disproportion or delay that can be overcome without injury to the mother and with probable safety to the child.

Dystocia arising in this way is met, (a) by increasing the vis à tergo, or driving force, by pressure on the uterus, or manual pushing-out of the child; (b) by putting on vis à fronte, or traction-force. Then the lever or forceps is indicated if he head present, and turning or traction by hand if the arm or breech present.

- 2. Disproportion that can be overcome without injury to he mother but with sacrifice of the child. The treatment ndicated is to reduce the bulk of the child by perforator, rotchet, cephalotribe, cranioclast, forceps-saw, écraseur, basio-ribe
- 3. Disproportion beyond either of the preceding cases, but o be overcome with possible or probable safety to mother nd child. This demands the Cæsarian section in its various addifications.

This classification is essentially clinical. The diagnostic diferentiation of the classes of cases does not necessarily demand precise recognition of the exact causes of the disproportion and difficulty. The preceding analysis of these causes, according to the factor affected—that is, the soft parts, the pelvis, or he fœtus—is essentially scientific and abstract. This scientific nalysis, again, differs from the clinical analysis in this: in the alter, two or more of the causes described in the scientific nalysis may, and frequently do, act in combination. One alone hight not produce dystocia in a serious degree; but two or hore of them, each by itself insufficient, may, by accumulating exaggerating action, produce serious dystocia.

This clinical survey of dystocia must be read in connection ith the symptomatology or history of dystocia, given at the troduction of the subject (see p. 522).

When labour is obstructed, one of two conditions of the etus occurs. It is either *impacted* or *arrested*. What meanig is attached to these terms? The fœtus may be stationary om simple arrest or from impaction. *Arrest* is due to want of cpelling power, or to some hitch from failure of accommodation of the fœtus to the particular part of the passages in which is placed. The fœtus may be arrested in cases where both alvis and fœtus are of normal proportions. It may also be rested in cases of disproportion, due to excessive size of the ead or very narrow pelvis, or from malposition, so that the

presenting part of the child cannot enter the pelvis, but rests upon it, movable.

Impaction, on the other hand, arises when the head or other presenting part is jammed in the pelvis, wedged in so that it cannot advance nor be easily pushed back. There is, as the French call it, 'enclavement.' This condition arises when the pelvis is contracted, but is open enough to admit the feetus a little way; it occurs in arm-presentations; even when the pelvis and feetus are normal, the child is wedged.

The signs of the fætus being in danger are convulsive movements or twitchings of its limbs. These are indications of impending asphyxia. The heart flagging, as ascertained by auscultation and feeling the cord; then pulse ceasing; voiding meconium. These signs indicate urgency to deliver in the child's interest; and this is rarely manifested without there being at the same time expediency, at least, to deliver in the interest of the mother.

CHAPTER XII.

FORCEPS.

CENERAL PRINCIPLES RULING OBSTETRIC OPERATIONS. THE FOR-CEPS: ITS POWERS; RULES GOVERNING ITS USE; APPLICATION IN OCCIPITO-ANTERIOR POSITION OF HEAD, IN OCCIPITO-POSTERIOR, FACE, AND BROW; OVERHANGING BELLY; AFTER-COMING HEAD. DANGERS ATTENDING USE OF FORCEPS.

The Operations.

General Discussion of Obstetric Operations.

The instruments—including the master-instrument, the hand—have been described in the chapter on the 'Armamentarium Obstetricium.' We have now to study the application of those instruments, the indications for their use, and the modes of using them.

Certain general principles govern obstetric surgery. The first, and most important of all, is to accept as our guide in every operation, as nearly as possible, the processes adopted by Nature in ordinary labour, and this rule applies with peculiar force to delivery by turning and by the forceps. In these operations the duty of the surgeon is to help Nature, not to supplant her. She is rarely utterly at fault.

Another principle of action is to ponder well whether we can save both mother and child. Turning and the forceps are generally designed to accomplish this twofold good result. This is the highest and most gratifying achievement of conservative. obstetrics.

The next principle is, when we are compelled to abandon the hope of saving mother and child, to do our utmost to save the mother. It is told of the great Napoleon, that when the question was put to him, in the case of his wife in labour, he, anxious as he was for an heir—a dynasty at stake—answered, 'Save the mother; it is her right.' To save the mother, even at the sacrifice of her child, is the plain duty of the surgeon.

Next comes the question, when the case of the mother is hopeless, how to save the child.

Lastly comes the question, having, either through experience of past labours or from recognition of danger during gestation, arrived at the conclusion that the safety of mother or child, or of both, is imperilled by letting gestation go on to term, whether we cannot by art avert threatening evil, by bringing the gestation to a premature conclusion. This operation brings us back to the highest aim of conservative obstetrics.

A lesson drawn from the above propositions is, that we trace in their successive applications the guide to a scale of operations. There is a progressive advance from the saving or conservative operations to the sacrificial operations. The operations stand in a series rising in severity. From the forceps and turning we pass to embryotomy and the Cæsarian section; and then, retracing our steps, we resort to the induction of labour.

A general idea of the indications which guide in the selection of operations, in so far as dystocia depends upon pelvic distortion, may be derived from the following

SCHEME OF RELATIONS OF PELVIC CONTRACTIONS TO MODES OF DELIVERY AT TERM; CHILD'S HEAD ASSUMED TO BE NORMAL.

Conjugate diameter reduced to	Operations at term.	Operations at seven months.
4 to 4.25 in. may end i	in natural labour	
4 to 3.75 in. ,, ,,	forceps or turning .	Natural labour
3.75 to 3.50 in. ,, ,,	turning	Forceps
3.50 to 2.25 in. ,, ,,	craniotomy	Turning
2·25 to 1·75 in. ,, ,,	{ craniotomy doubtful, } Cæsarian section }	Craniotomy
		Cæsarian section
		climinated

Taking the same measurements in labour at seven months, by sliding down the scale of operations, as in the third column, we find that natural labour takes the place of forceps, forceps of turning, turning of craniotomy, craniotomy of Cæsarian section: and thus the Cæsarian section is eliminated.

In this table there is seen some overlapping in the application of the various operations. It is obviously impossible to

construct rigid, absolute rules. Other factors besides that of mere pelvic narrowing commonly enter into the case.

The choice of the operation in any particular case is too often determined by the accidental and relative perfection of or familiarity with particular instruments. And so, it may be added as a corollary, will be the result to mother and child. Thus, a man who has only reached that stage of obstetric development which is content with a short or single-curved forceps, will be armed with more or less efficient perforator and crotchet. He persuades himself that the ease is not a fit one for the forceps, and so resorts to the easy but sacrificial operation of craniotomy. Or if he have been accustomed to use a comparatively short double-curved forceps like Simpson's, which will mostly fail to seize the head at the pelvic brim, he may resort to turning, an operation vastly more dangerous to the child; or to craniotomy, which destroys it.

At the present day we may boast of having good and efficient instruments of all kinds, each capable of doing excellent work in its own peculiar sphere, and, moreover, endowed with a certain capacity for supplanting its rival instruments. For example, the long double-curved or the triple-curved forceps is adapted to supplant eraniotomy in a certain range of cases of minor disproportion. Hence it follows that it is of more importance to have a good forceps which can save life, than it is to have a good perforator which destroys life. At the same time it is eminently desirable to possess the most perfect means of bringing the fœtus through a very narrow pelvis, in order to minimise the necessity of resorting to the Cæsarian section. Our aim, then, should be to perfect all our instruments, to make each one as good of its kind as possible.

And first, and above all, it is necessary to cultivate to the ntmost the master instrument, the hand. Many of the most difficult and beneficial operations are performed by the hand alone. Obstetric surgery has this peculiarity: its operations are carried on in the dark, our only guide being the information conveyed by the sense of touch. The mind's eye travels to the fingers' ends. The hand is a diagnostic as well as a surgical instrument. The hand thus possesses an inestimable superiority over all other instruments. Its every movement is regulated by consciousness. Even more than instruments vary does the

obstetric hand. Care and experience will to some extent improve the most clumsy. But just as a bad forceps cannot be made to do the work that a good one will easily accomplish, so the originally awkward hand will never attain to the skill of the master.

The powers of the forceps. The first point in the study of an instrument is to determine what it can do. We find that the powers inherent in the forceps are three. Thus, applied to the child's head, it is endowed: (1) with the power of compression—that is, of moulding the head; (2) with the power of traction; (3) with a leverage power.

1. Compression. The child's head, we have seen, is moulded under the normal pressure which it undergoes in its transit through the pelvis. This plastic property is an essential condition of accommodation. Either because the natural force is unable to propel the head in such a manner as to bring it within the range of the moulding factors, or from other causes, the forceps, by drawing the head down within this range, acts on the most strictly physiological principle.

The compression is effected in two ways: (1) By the direct compression of the head between the blades by pressure upon the handles; and (2) by the pressure exerted upon the bows of the blades by the resistance encountered in the passages as the head descends. This pressure serves to fix the blades upon the head, and thus the head is further compressed and moulded by the medium of the forceps. Thus the forceps aid Nature.

Different forceps vary greatly in the degree in which this property of compression is possessed. The old short single-curved forceps, with short handles, possess very little compressive force. What they do possess is due almost entirely to the pressure exerted upon the bows of the blades by the resistance of the passages.

Some even of the better models of long double-curved forceps owe their compressive power upon and grasp of the head to the same external pressure upon the bows. No matter how firmly the handles are gripped by the operator, it will be found with most English forceps that as soon as the equator of the head clears the pelvic outlet, the blades, losing the external support, are apt to slip off. The shanks are commonly made so slender that, when the handles are tightly

gripped, the blades adjusted upon the head find this globe too resisting to yield beyond a very small extent, and so the blades open a little—that is, the instrument 'springs.'

This fault—or advantage, according to the view taken—is not found in the French forceps, the branches of which are made stouter, and therefore spring but little, if at all. These forceps, therefore, grasp and mould the head in great measure through the leverage applied to the handles.

An interesting question, but one difficult to answer with precision, is: What is the measure of the compressibility of the head, compatible with safe delivery? Numerous experiments have been made upon dead children to determine this point. Baudelocque found that he could lessen the transverse diameter by a quarter to a third of an inch. Siebold gained half an inch. Osiander and Velpeau claim as much. Joulin and Chassagny proved that a degree of moulding still greater may be attained. But these experiments upon dead children are of doubtful application to the solution of the problem. The important clinical fact is that in many cases the child survives, although its head has undergone very great compression and moulding. The degree of compressibility compatible with life is probably a variable quantity. The following conditions influence the result: the degree of development of the head as to size and ossification, and the mode in which the compressing force is applied. If the force be applied gradually and intermittently, a much greater degree of moulding with less injury to the child may be obtained than what Baudelocque thought possible. The clinical experiment observed in the natural process of moulding indicates approximately the extent of compression that may be obtained with safety, and the conditions under which artificial compression should be applied.

ditions under which artificial compression should be applied.

Thus we have seen (p. 130) that the bi-parietal diameter of 4 inches may be reduced by the natural forces to 3.50 inches. But this gain could not be made by rapid forcible compression between the rigid blades of the forceps without endangering the child's life. The forceps must therefore be used slowly and intermittently.

This rule seems good both in logic and in physiology, but experience proves that there are cases where the head-moulding can be accomplished more quickly with safety by continuous

pressure. Delore, who has made many dynamometric observations, concludes that pressure, exerted either by the forceps or by the genital organs, may be harmless to the head if spread over a large surface. It is limited and angular pressure that is dangerous. He also established the rule that the greater the traction the greater is the pressure. The pressure is equal to about half the traction. Thus, if we exert a traction-force of fifty pounds, the pressure upon the head is about twenty-five pounds. These observations, again, illustrate the proposition already stated, that grasp and compression are greatly due to the pressure of the passages upon the bows of the forceps. It is necessary to remember that experiments of this description, made before the axis-traction forceps was used, are open to the fallacy that the traction almost necessarily involved some waste force by the vicious direction imparted to it.

2. The traction power. This is the most obvious property. It cannot well be dissociated altogether from, 3. The leverage power. It is more instructive to study these two forces together. The forceps is a double lever; cach branch is a lever and might be used as such separately; united, each branch acts as a fulcrum to the other. The lever application of the forceps is strongly denounced, but we think for want of right understanding of the question and want of delicacy of touch. It is simply a mechanical impossibility to pull with absolute unvarying straightness upon a rope or rod; some degree of oscillation is unavoidable; the best trained muscles, acting against considerable resistance, will sway a little. This is leverage, and the degree of leverage increases with the length of the rod—that is, of the forceps.

Leverage is a force indicated by Nature; it is a most important factor in the natural progression of the head. As the head advances, first one side of the head is felt a little lower than the other; presently a slight oscillation of the head on its long axis is perceived during its screw-movement, the side that was at first highest coming down a little. The adaptation of the head to the planes of the pelvis is largely effected in this manner. Since it is our business to help Nature by imitating her, it would be folly to reject this force.

The question then remains, how best to use this force?

¹ Gazette hebdomadaire, 1865.

The reply is, not by violent oscillations, carrying the handles first strongly to one side, then over to the other; not by making a fulcrum against the sides of the pelvis at the risk of crushing the soft parts, perhaps of opening the bladder; but by gentle, almost imperceptible, alternate movements, traction force being exerted at the same time, and making the blades of the forceps act as mutual fulcra, or by making a fulcrum of the fore-finger.

We are in the habit of demonstrating the safe and effective leverage of the forceps by using each blade alternately unlocked, making the finger serve as a fulcrum. In this way, in an ordinary case, the head may be seen and felt to descend as first one side of the head, then the other, is canted downwards. This is done without any traction force whatever; it is, in fact, the illustration of the action of the simple lever, an instrument now comparatively obsolete. If the simple lever be now neglected in favour of the more efficient double lever, it is at least worthy of remembrance for the lesson it teaches that its power is transferred to the forceps. Indeed, one of the earliest attempts, stimulated by the desire to realise the concealed discovery of the Chamberlens-that of Palfyn-consisted in applying two opposed levers which did not cross, and therefore could not exercise any direct compressive action. Assalini's forceps is the surviving representative of this principle. Its two opposed blades do not cross; its compressive power is due to external pressure upon the fenestræ; and its prehensile and traction power is due to the curvature of the blades upon the head.

The traction power obviously depends in the first place upon a good hold. This we have seen is effected partly by the outward pressure upon the fenestræ and partly by the curvature of the fenestræ embracing the head. This curve is more marked in the French forceps than in most of the English instruments, and in this we think the French forceps is superior.

Four rules should govern the use of the forceps: 1. The direction of the traction must be the axis of the pelvis. This has been demonstrated in describing the axis-traction forceps of Aveling and of Tarnier. Traction so applied, aided by 2. Slight lateral or oscillating movement, reduces the force required to the minimum, and this means the minimum of violence to the mother and the child, and, in some difficult

eases, suecessful delivery beyond the power of ordinary instruments. 3. Give time for the head to mould and for adaptation to be effected. 4. Aid the vis à fronte by putting on vis à tergo. This is done by a binder or the hands of an assistant pushing the head into the pelvis. In this way traction force to the extent of 5 lbs. to 7 lbs. may be saved. The child's trunk is kept with its axis coincident with that of the pelvis; this implies a saving of compressive force, and lessens risk of injury from stretching the child's neck.

We add a negative rule admitting of few exceptions: Avoid using the forceps to rotate the head; this rotation should be

left to the natural law of adaptation.

Knowing the power we hold in the forceps, we may now study how to use it.

Postulates for the useful Application of the Forceps.

- 1. The os uteri must be dilated, or dilatable enough to permit the blades to pass without stretching. To this rule there are some exceptions.
- 2. The fruit-sac must have burst. It is not necessary to wait for the evacuation of liquor amuii. Sometimes the uterus is paralysed by the head acting as a ball-valve; one blade then introduced gives a channel for the escape of the dammed-up waters.
- 3. The pelvis should be of normal proportions, or only contracted in the minor degrees.
 - 4. The head should be normal in size and firmness.
- 5. The bladder and rectum should be empty. We recommend to carry a catheter tied to the forceps, so that on taking up the instrument we are at once reminded first to use the catheter. Neglect of the state of the bladder has undoubtedly led to serious catastrophes.

6. Ether-narcosis is especially useful in the high operations.

Indications for the Use of the Forceps.

It may be premised as a general rule that if the forceps lock easily the conditions are favourable.

Ascending from the simple to the more difficult cases, we may divide the forceps cases in three classes:—

1. The head is in the pelvic cavity. This is the low operation. (a) There is simple arrest. (b) Arrest from persistent capping by the anterior or uterine valve (see p. 23, fig. 1). (c) Arrest with slight impaction from disproportion or unvielding state of the soft parts. (d) Arrest on perinæum in an oblique or transverse position, driving force wanting to rotate the occiput forwards. (e) Arrest from occipito-posterior position. (f) Arrest from vicious direction of the driving-force, from non-coincidence of the axis of the uterus with the axis of the pelvis, as with overhanging belly.

In most of the above cases the short, or so-called straight, forceps might be available, but the long forceps is better.

- (g) Arrest in the pelvis, the trunk being delivered—head-last labour.
- 2. The head partly engaged in the pelvic brim. This is the medium operation. (a) There is arrest from defective driving-force. (b) Arrest from imperfect dilatation of the cervix. (c) Arrest from slight excess of child's head—minor degree of impaction. (d) Arrest from slight projection of the promontory, so that the head is kept in the transverse position. (e) Arrest from face-presentation: (1) impaction, chin forwards, occiput compressed against nucha in strong extension; or (2) chin remaining backwards, impaction from wedging of head with back of child.
- 3. The head arrested on the pelvic brim or only slightly engaged. The high operation. (a) Arrest from want of driving-force, inherent debility, emotion, excessive distension of uterus from liquor amnii or twins. (b) Arrest from non-coincidence of uterine axis with pelvic axis, as in overhanging belly or marked obliquity of the uterus. (c) Arrest from minor degree of disproportion, head large or pelvis small.

In some of these cases the forceps is used tentatively. If the case prove intractable to the forceps, turning comes next.

4. In general terms, the forceps may come into requisition for low, medium, or high operation, to save from lingering labour, and in cases in which delivery is indicated apart from disproportion or malposition. (1) In the interest of the mother: (a) Some cases of hamorrhage; (b) convulsions; (c) to obviate exhaustion and uterine paralysis from protracted labour; (d) to obviate sloughing of vagina, vesico-vaginal

fistula, and rupture of perinæum. (2) In the interest of the child, the mother being in extremis.

In some of the cases specified, turning or craniotomy comes into competition with the forceps—first, as elective; secondly, as alternative operations. In the discussion On the Uses of the Forceps and its Alternatives in Lingering Labour, introduced by Robert Barnes in the Obstetrical Society, in 1879, the following propositions were submitted and met with general approval: It may be premised that the alternatives are waiting or expectancy, ergot and turning. 1. In lingering labour, when the head is in the pelvic cavity, the forceps is better than its alternatives. 2. In lingering labour, when the head is engaged in the pelvic brim, the pelvis being known to be well formed, the forceps is better than its alternatives. 3. In lingering labour, when the head is resting on the brim, the liquor amnii discharged, and it is known, either by exploring with the hand or by other means, that there is no disproportion or only a slight degree of disproportion, even although the cervix is not fully dilated, the forceps will generally be better than its alternatives. 4. In proportion as the head is arrested high in the pelvis, in the brim, or above the brim, the necessity. the utility, and safety of the forceps become more doubtful. 5. As a corollary from the preceding proposition, increasing caution in determining on the use of the forceps and greater skill in carrying out the operation are called for.

Dr. McClintock regarded it as one of the most generally true maxims in midwifery that as long as the membranes are entire and the liquor amnii present, no danger will accrue to mother or child by the continuance of the labour process, except from convulsions or hæmorrhage. But this requires some qualifications. Certainly, lingering labour involving the risk of exhaustion or rupture of the uterus may arise before the rupture of the membranes.

Modes of applying the forceps: the operation. The first thing to determine is the posture of the patient. We have to choose between the left lateral and the dorsal or lithotomy-posture. In this country the almost universal practice is to draw the patient to the right edge of the bed, placing her on the left side, the knees well drawn up. In France the dorsal posture is preferred. The patient is brought to the

edge of the bed, lying on her back, with the knecs raised and flexed, and supported by assistants. Each method has its advantages. National customs will probably be adhered to. In favour of the English custom it may be pleaded that it involves much less disturbance of the patient, that it requires no second assistant, and that it is for these and other reasons more convenient in home-practice. On the other hand, the dorsal posture is more favourable to maintaining coincidence of the uterine and pelvic axes, to support and compress the uterus by the hands of an assistant supplying vis à tergo, and to give more power and nicety of action to the operator during the last stage of extraction. The student should practise under both conditions on the phantom.

Selection of instrument. We will not encumber the subject by describing the mode of using the short forceps. As the greater includes the less, all that can be done by the short forceps can be done better by the long forceps; and he who can work with the long forceps will find no difficulty with the short.

Anæsthesia is not necessary, but may be called for. As in other surgical operations, the induction of anæsthesia should, if possible, be entrusted to a special assistant. The conduct of the operation is enough for the surgeon. Pass the catheter.

The forceps operation may be divided into four stages or acts: (1) The introduction and adjustment of the blades; (2) locking; (3) compression, traction, and leverage; (4) removal of the instrument when the head is born.

The blades should, in strict theory, be so applied as to seize the head in its bi-parietal diameter. This rule is insisted upon by Tarnier; but in practice this is often difficult of attainment. The pelvic curve of the long forceps practically determines the placement of the blades in accordance with the curve of the pelvic canal; thus, the blades naturally run into the sides of the pelvis, and grasp the head as it is found. It is true that the usual oblique position of the head will to some extent deflect the blades towards the bi-parietal diameter. The combined effect of these two factors will be to produce an oblique adjustment of the blades—oblique both as regards the pelvis and as regards the child's head.

In the great majority of cases, if the position of the fenestre

and the marks made by them on the fœtal head be observed after delivery, it will be seen that one fenestra was applied more or less behind the transverse diameter, and the other a little in front. The recognition of this fact much simplifies and facilitates the use of the instrument.

The application of the forceps in occipito-anterior positions when the head is delayed on the brim. The left lateral decubitus is assumed.

1st act. Dip the blades in warm water, wipe them dry, and lubricate with carbolised vaseline. To select the blade to introduce first, join the blades, and holding the instrument



Fig. 81.—First Stage of Introduction of First Blade. (R. B.)

with the concavity of its pelvic curve forwards, the blades in the position they are to occupy in the pelvis; take that one first which is to lie in the left or lower side.

One or two fingers of the left hand are passed in at the perinæum (see fig. 81), taking care to get them between the cervix uteri and the child's head. Then, bearing in mind the relative forms of the instrument, the head, and the pelvic canal, the point of the blade is passed along the palmar aspect of the fingers, at first nearly directly backwards towards the hollow of the sacrum.

2nd act. The handle is now raised, so as to throw the

point downwards upon the left side of the head. As the point of the blade must describe a double or compound curve—a segment of a helix—in order to travel round the head-globe, and at the same time to ascend forwards in the direction of Carus's curve to reach the brim of the pelvis, the handle rises, goes backwards, and partly rotates on its axis (see fig. 82).

3rd act. The handle is now carried backwards and downwards to complete the course of the point around the head-

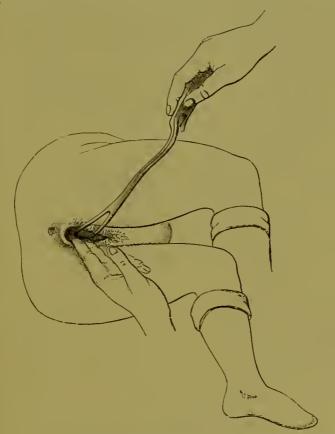


Fig. 82.—Second Stage of Introduction of First Blade. (R. B.)

slobe and into the left ilium. Slight pressure upon the handle bught to suffice. This will impart movement to the blade; the right direction is greatly determined by the relation of the sacrum and head. The blade is now in situ. The shank is to be pressed against the coccyx by the back of the operator's eft hand whilst he is introducing the second blade. Its weight hand in maintaining it in situ (see fig. 83).

Introduction of second blade—1st act. Two fingers of the VOL. II. Q Q

left hand, the back of which is supporting the first blade against the perinæum, are passed into the vagina and up between the os uteri and the side of the head which lies nearest to the right ilium. The instrument held in the right hand lies nearly parallel with the mother's left thigh, or

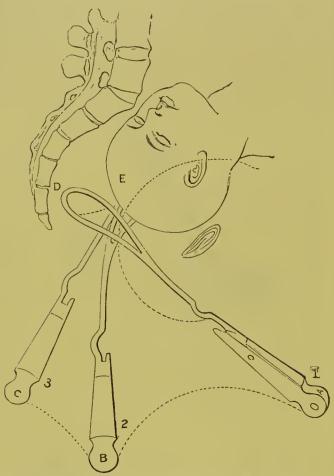


Fig. 83.—Introduction of the First or Left Blade. (R. B.)

1. First stage, or introduction of point of blade in the hollow of sacrum. A. The handle is then raised, and at the same time carried across, rotating partly on its axis to B, so that the point D, turning round in the hollow of the sacrum to E, strikes the head, and rises towards the left side of the pelvis. 2. The second stage, or advance of the blade round the head, and up in the left ilium. 3. The third stage: the handle B has travelled in the direction BC, still rotating slightly, until at C it is at rest in situ, the shank near the anus, where it is held by the back of the operator's left hand, whilst the point of the second blade is passed over and across it inside the perincum, as seen in next figure.

crossing it with only a slight angle. The point is slipped along the palmar aspect of the fingers in the vagina, across the shank of the first blade in situ, and inside the perinæum towards the hollow of the sacrum (see fig. 84).

2nd act. As the point of the blade has to describe a helicine curve to get round the head-globe and forwards in Carus's curve, the handle is now depressed and carried backwards until the blade lies in the right ilium. When it has reached this position the handle will be found near the coccyx, nearly in opposition to the first blade (see fig. 85).

The locking. This is effected by a slight movement of adaptation. A handle is seized in each hand. The handle of the first blade is brought a little forward over the handle of the second blade. If one blade is a little deeper in the pelvis than the other, it is either brought out or the other is carried



16. 84.—Showing Last Stage of Introduction of First Blade, and the Crossing the shank of this Blade by the Second Blade in the First Act of its Introduction. (R.B.)

n until the lock is adjusted. This is commonly facilitated by pressing both handles back against the coccyx. This movement, by throwing the fenestræ well into the ilia, where there is com, allows the handles to be rotated a little so as to fall into accurate relation (see fig. 85).

Accurate locking is generally evidence that the blades are properly adjusted, and that the pelvis admits of the successful use of the instrument. On the other hand, their not locking a proof of not being properly introduced, or of the pelvis not admitting of their application. In the first case—that of

improper introduction—the failure is generally due to neglect in passing the blades exactly in the same diameter of the pelvis—that is, in passing the second blade exactly opposite to the first, so that, if the first blade is applied in the left ilium opposite one end of the transverse diameter, the right does

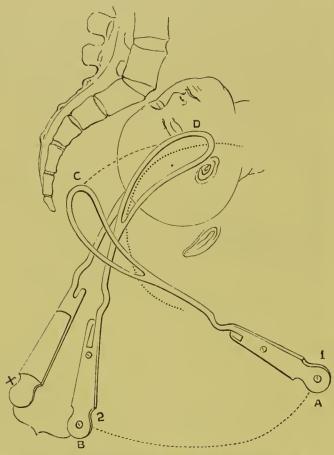


Fig. 85.—Introduction of the Second or Right Blade. (R. B.)

1. First stage. 2. Second stage. X. The first blade in situ. A. The handle at the moment of passing C, the point inside the perinaum, into the hollow of the sacrum, across X, the first blade; the handle A then drops and goes backwards to B, the point C travelling round the head, and advancing into the right ilium in the direction of the brim to D; when it has reached this position, it will be found nearly opposed to X, the first blade. The locking is effected by bringing the handle X over the handle B.

not lie at the opposite end of this diameter. To remedy this error, the blade must be partly or wholly withdrawn and readjusted.

In the second case—that of pelvic unfitness—the locking is probably prevented by the projecting promontory or other de-

formity so distorting the brim that the two blades cannot find room to lie in the same diameter opposite to each other. It will commonly be found that the blades will pass one on each side of the promontory, the inside of the blade not looking towards its fellow but towards the opposite foramen ovale, where a blade cannot be got to lie. When this happens it is best to give up the use of the forceps. Pass the hand into the pelvis if necessary, explore its dimensions and form carefully, and determine between turning and craniotomy.

The extraction. Get an assistant to press upon the right hip and support the back. Grasp the handles with one hand,



Fig. 86.—Showing Direction of Traction, First Stage, Head at Brim. (R. B.)

and apply the fingers of the other hand to the ring or shoulders at the lock; draw at first backwards in the axis of the brim, luring the pains if any be present, and at intervals of a minute or so if there be none. Concurrently with traction slight alternate leverage movements may be executed by swaying the landles gently from side to side within a moderate angle not exceeding 20°. Care is taken not to press the shanks against the pelvic walls. Each blade is the fulcrum to its fellow.

Extraction is assisted by pressure à tergo upon the fundus uteri.

The advance of the head is measured by the following standards: First, you feel if the occiput approaches the pubic arch by passing a finger below and behind the pubic bones; secondly, sweep the finger round the circumference of the brim, and thus feel if the equator of the head-globe is pressing lower down through the brim; thirdly, by feeling the direction of the sagittal suture: if you find that it is approaching parallelism with the conjugate diameter you may be certain that the head is descending. Further evidence is found in the rotation of the forceps. As the head can hardly turn upon its cervicovertical axis without at the same time descending in the pelvis, if the handles of the forceps rotate, this rotation, being imparted by the head, is evidence of advance.

Again, as the head descends, of course more and more of the shanks will become visible. This is, indeed, open to a fallacy; allowance must be made for some degree of slipping which takes place with all the English instruments whose blades have only a moderate bow. And, further, when the head is fairly in the pelvic cavity the blades lose in some degree external support.

Fourthly, by two or three fingers you gauge the space or degree of tightness between the vertex and the floor of the pelvis. At first there is free space; gradually the vertex presses on the perinæum, bulges it out, and puts it tightly on the stretch. The anus is protruded, fæces are often squeezed out; indeed, the pressure upon the sphincter ani and vulva at this stage sets up increased reflex action; the call to strain or bear down is uncontrollable. Turbulent expulsive action, then, and defæcation constitute strong signs that the head is advancing. To some extent the increasing caput succedaneum may give a false impression that the cranium itself is descending; but a little attention will correct this error.

At this stage the handles of the forceps may be directed more forwards during traction; the shanks thus avoid stretching the perinæum, and the traction is in the axis of the outlet. An assistant is now useful in holding up the right knee, so as to leave room for the operator to carry the handles well round the pubes in Carus's curve. Here it is often convenient to push the handles forward rather than to pull.

The forward direction of the handles must not begin until

the occiput is well under the pubic arch. During extraction it occasionally happens that the blades lose their hold, that the blades will twist in opposite directions and thus unlock; this is generally owing to carrying the handles forward too soon. The effect of this is to throw the fenestræ off the head-globe over the face. This is another illustration of the law that the position of the forceps is determined by the relation of the position of the forceps is determined by the relation of the head to the pelvis, and that if we reverse the order by attempting to make the forceps alter their position we are immediately at fault. Axis-traction simple is the law to follow. When the blades slip the remedy is to carry the handles well back, when the lock will be readjusted. During the passage of the head the perinæum should be supported by bringing it well forward. By firm pressure from behind and on either side the head is assisted in its exit. Another manœuvre is sometimes serviceable; this is to pass a finger into the rectum, so as to get a point of pressure upon the forehead. In this way it is sometimes possible to bring the face downwards, to start the extension movement, and thus to extricate the head. And if at the sion movement, and thus to extricate the head. And if at the same time firm downward pressure be made upon the breech through the fundus, the force propagated through the spine will aid materially in giving the exteusion movement. This combination of pushing, of leverage, and of 'shelling-out' may in certain cases effect delivery without resorting to the forceps. If the head is in the genital fissure, and there is sufficient propelling force, we may proceed to the fourth act, the removal of the blades. But generally it is better to keep them on the head as one piece with it until the head is entirely born.

The time required for extraction. If the head be delayed in the pelvis for want of expulsive action, or because it rests upon the ischia, maintaining a too near approach to the transverse diameter, and there is no marked hindrance on the part of either the anterior or posterior valve, it is generally sufficient to use slight traction and oscillation for a few minutes. As soon as the head is started by the forceps the uterus takes up its work, helps the operator, and the labour is quickly over.

If the head has to be seized at the brim from inertia of the uterus, time may often be saved by placing the patient on her back, and supporting the uterus against the spine by the hands of an assistant or a binder. This proceeding, by adjusting the

axis of the uterus to that of the brim and getting the aid of gravitation, will greatly facilitate the entry of the head and encourage the action of the uterus. If there is no obstacle in the condition of the passage, gentle traction and oscillation during fifteen minutes will generally complete delivery.

In the event, however, of arrest from pelvic contraction or from want of dilatability of the soft parts, time is a necessary element. The process of moulding can only be effected gradually. Oscillation must be used with great care; what is wanted is steady compression and traction, extended, with moderate intervals of rest, over perhaps an hour or more. Should the head make no advance in entering the brim in that time, and if the handles of the forceps maintain a marked degree of divergence, and the signs of dystocia rise to indicate exhaustion, the question whether the forceps must not be laid aside for turning or perforation will have to be considered.

The forceps in occipito-posterior position. The study of this case is especially interesting on account of the frequency of its occurrence. In the majority of the cases to which we have been called to apply the forceps, the delay was due to this position. The mechanism of labour in this position has been described (see p. 170 et seq.) The occiput, taking the promontory as the analogue of the symphysis pubis, is relatively fixed to this point, whilst the head, revolving in Barnes's curve, gets into an unfavourable position in the sacral hollow. The head undergoes extension in the pelvis. Hence the liability to arrest. Release can only be obtained by a movement of flexion.

Flexion may be obtained in two ways: first, by conversion into an occipito-anterior position; secondly, by taking the symphysis as the centre of rotation, and the point against which the root of the nose or the forehead is fixed, whilst the vault of the cranium is made to roll over the floor of the pelvis and through the outlet.

The first question that arises, then, is whether we can hope for the change, spontaneously or by art, to an occipito-anterior position. At p. 170 experiments by Dubois are cited, showing that if onward movement be given the tendency to this conversion is great. Smellie effected the change by the forceps. Clarke and Burns said it could be made by the fingers.

R. U. West applied his fingers to the frontal bones, turning this part backwards, and at the same time tilting it up until he felt the posterior fontanelle come down. In another case he brought the occiput down by the lever. As soon as the occiput eame down, the rotation seems to have been effected by Nature. The essential thing to do is to get the occiput down—that is, to restore flexion. We are persuaded that the head often turns of its own accord when we think we are helping it. Dr. Millar, after assiduously working after the manner recommended by Baudelocque and Dewees, in a considerable number mended by Baudelocque and Dewees, in a considerable number of eases let Nature take her own course, and 'found that the desired rotation was generally accomplished about as well without as with his assistance.' Leishman says, 'We may succeed in amending the position in two classes of eases. In the first, the head is free at the brim, and here rotation may be effected by the forceps. In the second, the head has reached the floor of the pelvis, where we have natural rotatory forces operating in our aid. No attempt, while the head is in a position intermediate between these two, is likely to be attended with success. In the second class of cases the forceps is quite inapplicable (for the purpose of rectification). We ceps is quite inapplicable (for the purpose of rectification). We must employ our whole efforts in promoting the preliminary flexion. This is done most effectively by bringing two fingers to bear upon it, and pressing in the direction indicated during

We have found that the occiput must be brought down below the edge of the saero-sciatic ligament to permit of the rotation face backwards. But we cannot give more than a qualified assent to the attempts to rectify the position. It is only exceptionally useful; still more rarely is it necessary; and it is not free from danger. In Leishman's first case, the head free at the brim, it is quite premature to interfere. The rotation is most likely to take place spontaneously if let alone. In the second ease, his manœuvre postulates a driving force. This is often wanting. The pains are apt to flag when the head is on the floor of the pelvis.

The fact is that the head can be born very well, preserving the occipito-posterior position throughout. We think this occurs more frequently than Naegelé represents. Nor does the case call for force. By help of the forceps the delivery is nearly

as easy as in occipito-anterior positions. In the event of delay then we advise resort to the forceps.

In traction there are two things to be observed: the perinæum is put more upon the stretch, and therefore requires more care; if the handles of the forceps are carried forwards towards the mother's abdomen too soon, the bows will be apt to slip off. The perinæum is severely tried, and laccration is sometimes unavoidable.

The blades should be introduced as described in the case of occipito-anterior positions. They will be guided by the head into the most suitable position. Extraction simply, without troubling ourselves about rotation, is all that is necessary. If Nature prefer to insist upon rotation, our business is to assent. As the head advances, the occiput may come forwards. But in a large proportion of cases Nature will not insist upon bringing the occiput forwards; and here, again, our part is simply that of a minister of Nature. The forchead will emerge under the pubes; the cranium will sweep the sacrum and perinæum.

As the blades of the forceps preserve their original relation, the handles will turn with the head. It is labour lost, it is encumbering Nature with superfluous help, to attempt to promote this turn by twisting with the forceps.

The forceps in brow- and face-presentations. The mechanism by which these presentations are produced has been described (p. 175). The study of this process indicates the principle upon which rectification must depend. The face descends because the occiput, encountering excess of friction against the pelvic brim or in the lower segment of the uterus from obliquity, the head rotates on its bi-parietal diameter. We have seen that, if excess of friction can be transferred to the forchead or anterior pole of the head-lever, the occiput may descend, and the vertex be substituted for the face. We also showed the processes by which Nature extricates herself from the difficulty when the head and part of the thorax get jammed in the pelvis. Sometimes, however, the head in face-presentations is neither rectified by art nor by Nature. It is arrested in the pelvis.

Let us first take the case of arrest in that stage of facepresentation when the chin has effected its rotation forwards, coming under the pubic arch. In figs. 28, 29, p. 177, we see this condition. The head is in strong extension; occiput jammed between the shoulders. This extension was produced by the relative fixing of the occiput on the pelvic brim, whilst the face and chin travelled in Barnes's curve. Now the object desired is to restore flexion, so as to decompose the wedge formed by the head and thorax. This is to be done by making the head rotate on its transverse axis, bringing the occiput down and making it travel through the pelvis in Carus's curve. The problem, in short, is how to reverse the movement by which the face-presentation was produced.

The blades of the forceps should be applied so as to seize the head nearly in its transverse diameter. Now, the face presents some degree of obliquity in relation to the pelvis. The first or sacral blade, therefore, must pass up the left side of the pelvis, somewhere between the sacro-iliac joint and the left extremity of the transverse diameter. The second or pubic blade will pass in the opposite point of the pelvis—that is, between the foramen ovale and the right extremity of the transverse diameter. When locked, traction is at first directed downwards to get the chin fairly under the pubic arch. Then the traction is directed gradually more and more forwards and upwards, so as to bring the vault of the cranium out of the pelvis. The posterior part of the head puts the perinæum greatly on the stretch. The final stage of extraction requires great care. Give time for the perinæum to dilate. Carry the handles well forward so as to keep the shanks out of the way.

But some cases will not proceed so smoothly. Some of the most difficult cases to which we have been summoned have been face-presentations. Sometimes the face will not enter the brim. What is to be done? If we apply the forceps one blade is likely to seize beyond the jaw and compress the neck, bruising the trachea. If the attempt be made to seize the head by applying the blades in the oblique diameter, the fenestræ must be passed very high, and even then may slip; if firmly grasped and traction be made, the faulty extension of the head is increased, the compression of the vessels of the neck and the danger of apoplexy are augmented, and after all extraction may have to be completed after perforation.

Turning can be effected with infinitely less trouble, and with a better prospect for the child.

In another class of cases, the face has descended into the pelvis. The birth of a full-grown living or recently-dead child, the forehead maintaining its direction forwards, is almost impossible. The extension of the neck is extreme, the head being doubled back upon the nucha. The chin represents the apex of a wedge, A B C (see fig. 30, p. 179), the base of which is formed by the forehead, the entire length of the head, and the thickness of the neck and chest. This

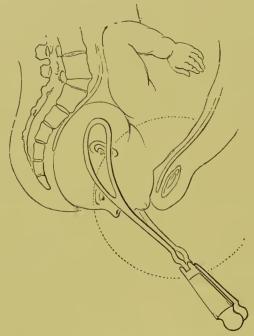


Fig. 87.—Showing Extraction by Forceps, Chin under Pubes. (R. B.)

must be equal to at least seven inches. The bregma and occiput become flattened in, but not much is to be expected from moulding. The case is that the natural mode of decomposing the wedge by the rotation of the chin forwards will not take place. Hence arrest or impaction. The child is in imminent danger. Aid becomes necessary. We have to consider the following points:—

1. Can the head be rotated on its transverse axis, restoring flexion in the pelvis? This is scarcely possible when the head is jammed in the pelvis.

2. Can the turn of the chin forward be effected by the hand, lever, or forceps? This is sometimes possible, and should be tried. The method is thus described by Smellie: 'After applying the forceps along the ears, push the head as high up in the pelvis as is possible, after which the chin is to be turned from the os sacrum to either ischium, and afterwards brought down to the inferior part of the last-mentioned bone. This done, the operator must pull the forceps with one hand, whilst two fingers of the other are fixed on the lower part of



Fig. 88.—Brow-presentation. (R. B.)

the chin or under-jaw, to keep the face in the middle and prevent the chin from being detained at the os ischium as it comes along, and in this manner move the chin round with the forceps and the above fingers brought under the pubes, which done the head will easily be extracted.'

3. Can the head be brought down by the forceps without turning the chin forwards, trying to extract in Carus's curve?

This is a practice against Nature. The forceps will be likely to slip, and if it hold it will bring more of the wedge into the brim. The head must be small or the pelvis large to admit of success.

- 4. Shall we extricate the head by perforating it? In extreme cases this course may be necessary. It is not easy, unless the bones be broken away, or crushed in by the cephalotribe.
- 5. The chin will sometimes turn forwards at the very last moment, when the face is quite on the floor of the pelvis. If not, it may be possible to hitch the chin over the perinæum by drawing the chin forwards by the forceps and pulling the perinæum backwards (see fig. 30, p. 179). The chin thus outside, the forceps may be applied to draw the occiput down under the pubes and backwards, so as to make the head revolve on its transverse axis around the coccyx as a centre in the coccygeal or Aveling's curve. The delivery is thus effected by a process the reverse of that of ordinary occipito-anterior labour, and in a different orbit. In the mento-sacral position the delivery takes place by promoting flexion. Bilateral incision of the perinæum may be desirable to facilitate the release of the chin.

Dystocia from pendulous or overhanging belly—the 'utérus en besace.' Since a main factor in the production of this condition is an extremely lax state of the abdominal walls, it is most frequent in women who have borne many children. In some cases there is separation of the recti abdominis muscles along the linea alba; then there may be hernia of the gravid uterus. Another favouring condition is contraction of the pelvis with lordosis. The projecting lumbar curve throws the uterus forwards. When this condition exists, the uterus, hanging down like a pack-saddle over the pubes, is widely out of the axis of the pelvis; and if there is pelvic contraction, the child would be directed over the brim, against the promontory (see fig. 89).

This fault may sometimes be remedied by placing the woman on her back, and supporting the abdominal walls by applying a broad binder, so as to lift up the fundus of the uterus. This will restore the relation between the axis of the uterus and that of the pelvic brim. But if contractile energy

be still wanting, the forceps will come into requisition. This is a case where the dorsal decubitus is especially desirable.

The alternative of the forceps in these cases is likely to be

The alternative of the forceps in these cases is likely to be turning. How shall we determine the choice? There are two principal cases: First, the liquor amnii has drained off and the head is pressing into the brim. The forceps is strongly indicated here. Secondly, the head is mobile above the brim, and not easy to grasp in the forceps. If by pressure we cannot push the head into the brim, turning will be preferable. We have several times rescued a living child by turning under these circumstances. The second case may sometimes be reduced to the first, and thus brought within the more desirable dominion of the forceps. One result of the pendulous belly and uterus is to form a kind of reservoir in which the liquor amnii is dammed up; hence an added impediment to contraction of the uterus. The waters can be drained off by lifting the fundus uteri up to its normal position, and making a channel past the head to the uterine reservoir by introducing one blade of the forceps. Having accomplished this, under steady pressure by the hands or a broad belt, the uterus may recover its form and expel the child. If not, the forceps comes into play.

Until the uterus is brought to its normal position, two causes concur to render labour difficult. First, the uterus being thrown forwards, its fundus is carried away from the diaphragm and upper part of the abdominal walls. It loses, therefore, the aid which the expiratory muscles, acting powerfully when the glottis is closed and the chest is fixed, usually give. When the uterus is thrown forwards across the pubes, any force propagated downwards from the diaphragm will strike the posterior wall of the uterus at a right angle with the body of the uterus and the long axis of the fœtus. It will, in short, drive the uterus and its contents down upon the symphysis, or even more forwards still, since the body of the child, which lies in front of the symphysis, forms the longer arm of a lever, and the force is expended upon it (see fig. 91).

Secondly, the uterus, if not paralysed, acts in a wrong direction. It is a law, of which the patient observer will not fail to discover many proofs in the progress of difficult labour, that whensoever a mechanical obstacle is encountered, before long,

the uterus, conscious, as it were, of the futility of its efforts, intermits its action, takes a rest until the time shall arrive when it can act with advantage. This provision protects for a long time against exhaustion from protracted labour and the danger of bursting. Indeed, what appears to be protracted labour is often simply 'suspended labour.'

In fig. 89, the uterus and child are represented lying across

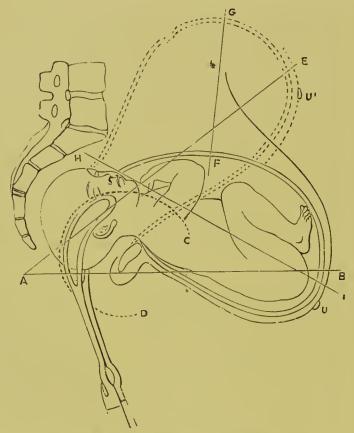


Fig. 89.—Showing Mode of Dealing with Over-hanging Uterus. (R. B.)

A B. Datum-line. C D. Carus's curve. A E, Axis of pelvic brim, F G. Line of expiratory force. H I. Line of uterine force.

the symphysis pubis: HI is the line in which the proper uterine force would be exerted; FG is the line of force of the expiratory muscles, striking the long axis of the uterus behind and nearly at a right angle. These two forces, which ought to coincide, thus cross each other, and the error is but imperfectly compensated by the resultant force obtained between the two. But

raise the uterus to its normal position, as indicated by the dotted outline, and immediately the expiratory force and the uterine force coincide with the axis of the child and of the pelvic brim, and both conspire to expel the contents of the uterus.

In the case of pendulous belly from contracted pelvic brim, the restoration of the axis of the uterus to its proper relation with that of the pelvis can rarely be effected until the head is brought into the pelvic cavity; and this has to be done after craniotomy. Then the dorsal decubitus and upward support of the abdomen and uterus come in effectively.

The forceps to deliver the after-coming head. In breech and turning cases, it is a matter of great moment to deliver before the cord has undergone long compression. In the majority of cases, provided the passage of the breech, trunk, and shoulders have not been hurried, the cervix will have been dilated enough to allow the head to follow without dangerous delay; but if, in consequence of precipitate aid, the arms run up by the sides of the head, or other obstacles occur, the head may be caught in the brim and the child may be lost. Besides compression of the cord, the child has to run another not less serious danger—this is dislocation of the neck, if traction be unskilfully or hastily performed. It is practically very difficult in some eases to draw the head by the shoulders in due axial direction. The slightest deviation from this direction involves hitching against the pelvic brim; and under continued traction the intervertebral ligaments are apt to give way.

Both these dangers are best averted by putting on the forceps. Traction then bearing upon the head, all drag upon the spinal column is spared.

How to apply the forceps: In the first place a loop of cord should be gently drawn down, so as to take off any dragging upon the umbilicus, and place the part which traverses the brim in that side in which the face is found. The head is engaged with its long axis more or less nearly in the transverse diameter of the brim. The blades should seize it in an oblique diameter approaching the conjugate. To effect this, the child's trunk should be carried well forwards over the symphysis, and held there by an assistant, so as to leave the outlet clear for manipulation. Then, passing the left hand into the vagina, carry the fingers to the left side of the pelvis between the

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cervix uteri and the head. The blade is slipped up along the palmar aspect of the fingers to its place. The like proceeding is then repeated on the right side of the pelvis, and the blades are locked. The assistant still (see fig. 90) supporting the child's body, the operator draws the head into the pelvis in the axis of the brim. As soon as this is cleared, the forceps may be removed and extraction finished by the hands. This is done by hooking two fingers of the right hand over the back of the neck on the shoulders, whilst the left hand seizes the feet above the ankles, a napkin interposed. Then extraction is made in the axis of the pelvic cavity and outlet. It is the work of a



Fig. 90.—Showing Forceps applied to After-coming Head. (R. B.)

few seconds. Some will prefer completing the extraction with the forceps. If this mode be adopted, the face will be found turned towards the sacral hollow when the head has cleared the brim; the forceps, following the sacral curve, rotates a little during traction. When the occiput is appearing under the pubic arch, the handles are carried well forwards, so as to bring the face over the perinæum with the least possible strain. The face and forehead sweep the perinæum, describing a curve round the occiput resting upon the pubes.

The use of the forceps to the after-coming head was

strongly inculcated by Busch, who attributes to this practice the extraordinary success of turning in his hands. Of forty-four cases of turning, only three children are said to have been lost from the effects of the operation. E. Rigby and Meigs also insisted upon the advantage of the practice. Our own experience enforces the precepts of these eminent authorities. If the practice have not been better appreciated in this country, it is because it is only within the last thirty years or less that a forceps adequate to the work has been generally known.

Dangers to Mother and Child from use of Forceps.

- 1. The low operation—head in pelvis, no disproportion or malposition, performed in time with proper skill—is absolutely harmless to mother and child.
- 2. The medium operation—head high in pelvis—is attended by some risk to mother from protraction; from bruising or crushing soft parts of mother. Thus the obturator nerve or the sacral plexus may be compressed, and temporary paralysis of the parts supplied by them may result.

 The child's head has to undergo more compression; a blade

The child's head has to undergo more compression; a blade may bruise the portio dura, and paralysis, temporary, of the eyelids and mouth result.

3. In the high operation—head on brim—the dangers rise. To the mother there is more risk of laceration of cervix uteri, of bruising the vagina. But if skilfully performed, and in time, the operation itself can hardly be said to involve mortality. To the child the risk to life from compression is serious; but this risk is to be set against the probably greater risk of turning, and the certain destruction of craniotomy. The cranial bones are sometimes depressed, even bent, bloodeffusions caused in the scalp and between dura-mater and cranium, or the brain itself injured. There is greater likelihood of injury to the portio dura. Sometimes the eyeball is injured.

of injury to the portio dura. Sometimes the eyeball is injured.

All these injuries are more probable when there is slight projection of the promontory. The depression of the skull may be due to this.

George Kidd, Johnston, and Atthill generally agree in the conclusion that in proportion as the forceps was freely used in cases of tedious and difficult labour, the deaths of the mothers

decreased, and the lives of the children were saved. Under Atthill the use of ergot was absolutely prohibited in the Rotundo Hospital.

Note on the Value of Statistics as applied to Obstetric Operations.

Gross indiscriminate statistics, seeming to show that forceps and other operations have caused a certain mortality, are fallacious. The issues of operations under different circumstances must be discriminated. Rigorous analysis on clinical lines must precede the construction of tables. Accidents which ought to be set down to delay, neglect, and unskilfulness, have been set down to operations which are essentially conservative.

CHAPTER XIII.

Version or Turning.

SPONTANEOUS; ARTIFICIAL; CEPHALIC; BI-POLAR; DESCENT OF HAND BY SIDE OF HEAD; PROLAPSE OF UMBILICAL CORD; ENTANGLEMENT OF CORD; DIFFICULT BREECH-LABOURS; DIFFICULT TWIN-LABOURS; NUCHAL DISPLACEMENT OF AN ARM; EXCESSIVE SIZE OF CHILD'S ABDOMEN; DYSTOCIA FROM MONSTERS; HERNIA; PODALIC BI-POLAR TURNING, LIQUOR AMNII PRESENT, AND WHEN RUN OFF; IMPACTION; IMITATION OF SPONTANEOUS EVOLUTION; EVISCERATION; BISECTION; DECAPITATION; SPONDYLOTOMY; TURNING IN NARROW PELVIS; DANGERS TO MOTHER AND CHILD FROM TURNING.

TURNING ranks next to the forceps as a conservative operation. It competes with the forceps on the conservative side, and with craniotomy against sacrificial obstetrics. Before the forceps came into use, there is no doubt that turning was much more frequently resorted to; and it may be added that with the improvements in the forceps the motive for resorting to it diminishes.

In this chapter certain cases of dystocia, not necessarily involving turning, are described.

Definition. Version comprehends all those proceedings by which the long axis of the child is brought into coincidence with the axis of the pelvis.

In familiar language we call the operation turning; the synonyms are: versio, version, Wendung.

Version may be: (1) Spontaneous; (2) Artificial.

1. Spontaneous version has been described in the chapter on the 'Mechanism of Labour' (see p. 201).

In spontaneous version, Nature points out the object to be attained, and how to attain it—that is, by artificial version. A spontaneous version may be effected either by bringing the head

first into the pelvic brim or the breech; so one of the like changes of position is sought to be accomplished by artificial version.

2. Artificial cephali cversion. The conditions favouring this operation are: (a) The latter end of gestation; (b) the presence of liquor amnii; (c) moderate obliquity of the uterus and child's axis in relation to the axis of the pelvis; (d) the head being near the pelvic brim.

The operation. A successful imitation of natural version demands the concerted use of both hands. We must act simultaneously on both poles of the fœtal ovoid. This action may be carried out altogether externally—that is, through the walls of the abdomen; or one hand may work externally whilst the other works internally through the os uteri. The first method—that practised by Wigand, Esterlé, and others—has been called the bi-manual proper; the second, which was first clearly taught by Braxton Hicks, was called by him 'combined internal and external version.' Both are forms of bi-polar version. This term, proposed by Robert Barnes in the first edition of the 'Obstetric Operations,' has since been generally adopted. Each form has its own field of application. But the combined internal and external bi-polar method has the more extensive applications in practice.

The history of bi-polar version demands a few lines. It seems clear that Wigand, D'Outrepont, and others who took up Wigand's views, had acquired an accurate perception of the theory of bi-polar turning, and had successfully applied it in practice. They had applied it to the purpose of altering the position of the child before labour, chiefly by bringing the head over the centre of the pelvis, restoring at the same time the uterus and fœtus from an oblique to a right inclination. This they did chiefly by external manipulation, but not exclusively, for sometimes one or two fingers introduced into the os uteri served to drag the lower segment of the uterus to a central position, whilst the hand outside acted in the opposite direction upon the upper pole. There the application seems to have stopped short. At least, we are not aware of any distinct description of the application of the bi-polar principle to produce complete version.

In one form the bi-polar principle of turning by the feet

has been in use for a long time. In oblique presentations, when turning is attempted after the waters have escaped and the uterus has contracted upon the child, it may be found that although one or both feet have been seized the head will not recede or rise. It then becomes obvious that by some means the head must be pushed up. This is commonly effected by holding down the leg or legs whilst a hand or crutch passed into the pelvis pushes up the head and chest. In this operation both hands work below the pubes.

In several works—those of Moreau, Caseaux, Churchill, and others—diagrams are given representing one hand applied to the fundus uteri outside and the other seizing the feet inside; but it would be an error to suppose that these indicate an appreciation of the principle of bi-polar turning. They simply indicate the principle of supporting the uterus, so as to prevent laceration of the cervix whilst pushing the head into the uterus. The true bi-polar method does not involve passing the hand into the uterus at all.

Sir James Simpson (1845) got nearer the mark: 'Use both your hands for the operation of turning. . . . Whilst we have one hand internally in the uterus, we derive the greatest possible aid in most cases from manipulating the uterus and infant with the other hand, placed externally on the abdomen. Each hand assists the other to a degree which it would not be easy to appreciate except you yourselves were actually performing the operation. . . . The external hand fixes the uterus and fœtus during the introduction of the internal one; it holds the fætus in situ whilst we attempt to seize the necessary limbs, or it assists in moving those parts where required towards the introduced hand; and it often aids us vastly in promoting the version after we have seized the part which we search for. Indeed, this power of assisting one hand with the other in different steps of the operation forms the principal reason for introducing the left as the operating hand.

Here the principle of bi-polar turning is at best but dimly foreshadowed.

Robert Lee practised a manœuvre of *tipping* the presenting shoulder or breech away from the os uteri by one or two fingers passed through the os only. This was mostly done in cases of placenta prævia, the fœtus being premature and small. It is

not shown that he used an external hand. By a process of synthetical reasoning Robert Barnes had arrived at the true principle. In the 'Obstetric Operations,' 1876, he says that in more than two hundred cases of turning he had never failed to follow Simpson's precept to use both hands, and he gradually found out that the external hand often did more than the internal one, so much so that the introduction of one or two fingers through the os uteri, to seize the knee pressed down upon the os by the outside hand, was all that was necessary.

Still, Braxton Hicks's claim to originality in working out and expounding the application of the external and internal bi-polar method of podalic version is indisputable. His work in this subject is contained in a memoir in the 'Lancet,' 1860, in the 'Obstetrical Transactions,' 1863, and in a special work in 1864.

Artificial cephalic version. As head-presentation is the type of untural labour, it follows that to obtain a head-presentation is the great end to be contemplated by art. But, practically, head-turning is little known. Delivery by the feet is almost universally practised when the substitution of a favourable for an unfavourable presentation has to be accomplished. Why is this? The answer is not altogether satisfactory; it rests chiefly upon the undoubted fact that, in the great majority of instances, at the time when a mal-presentation comes before us, turning by the feet is the only mode of turning which is practicable. Frequent experience of one order of eveuts is apt so to fill some minds as to exclude the recognition of events that are observed but rarely. They conclude that the course which is proper for most cases is proper for all; and, adopting this course in all cases, they shut out the possibility of learning what Nature can do or what can be achieved by other

In the seveuteenth century and in the beginning of the nineteenth, Velpeau remarks that cephalic turning was hardly ever mentioned unless to be condemned. Flamant was amongst the first to revive the practice. In two cases of arm-presentation he raised the breech towards the fundus uteri; the head, thus made to descend, was seized by the hand. The liquor amuii had long escaped. He worked in these cases entirely by internal manipulation. Wigand accomplished the same object

by external manipulation, saving the children. E. Martin, Hohl, Lazzati, and others advocate the practice.

The indications for head-turning. A. Before the accession of labour: When the uterus and fœtus are placed obliquely in relation to the pelvic brim; and in some cases where the shoulder is actually presenting. B. When labour has begun:

1. When the uterus and fœtus are placed obliquely in relation to the pelvic brim, which obliquity may be preparatory to the complete substitution of the shoulder for the head.

2. In some cases of shoulder-presentation, the membranes being still intact.

3. In some cases of shoulder-presentation, the membranes having burst, but considerable mobility of the head being still preserved.

4. The forehead or face presenting.

5. Descent of the hand by the side of the head.

6. Prolapse of the umbilical cord by the side of the head.

A. Head-turning or rectification before labour. Esterlé, the great advocate for this operation, was led to adopt it from the observation of the frequent occurrence of spontaneous version (see p. 211). He had remarked that this change had occurred after the escape of the liquor amnii and the shoulder was down. The patient must be placed in such a posture as to produce the greatest possible muscular relaxation. Bearing in mind the conditions which take part in spontaneous version, it is necessary to imitate them as much as possible. Amongst these is the lateral contraction of the uterus, which diminishes the transverse diameter, and which exerts a convenient pressure upon the ovoid extremities of the child; and the movements of the fœtus, the repercussion of its head, and its descent, when the centre of gravity of the feetal body favours its fall. To imitate this, the lateral contractions must be replaced by lateral pressure. This is applied towards the fundus or the cervix, according to the situation of the part which it is sought to raise or to depress. This pressure is assisted greatly by gentle strokes or succussions by the palm of the hand alternately towards either ovoid extremity. These strokes are then made in rapid succession simultaneously upon the two extremities, one giving a movement of ascent, the other a movement of descent; or we may act upon the head alone, whilst the other hand makes a steady pressure on the contrary side, the more

¹ Lehrbuch der Geburtshülfe, 1862.

to diminish the transverse diameter. The desired position being effected, it is necessary to maintain it. This is done by the adaptation of cushions or pads to the sides of the opposite poles of the feetal ovoid, and supporting them by a bandage.

B. 1, 2, 3. Head-turning may be tried in cases of moderate obliquity, the liquor amnii being still present, or only recently escaped. It is also important that the action of the uterus be moderate. Supposing the case to be one in which the head is deviated to the left ilium, and the fundus, with the breech, are directed to the right of the mother's spine, the first step is to place the woman on her left side. In this posture, the fundus of the uterus, loaded with the breech, and being movable, will tend to fall towards the depending side. This will act as a lever upon the uterine ovoid, and the lower end of the uterus with the head in it, so as to facilitate its return to the brim. In such cases, Wigand recommends that the posture should be repeatedly changed, so as to ascertain which is the best to maintain the head in the central line of the pelvis. When this is found, the sooner the membranes are ruptured the better. The patient must henceforth be kept carefully in the same posture, the uterus being supported in due relation by the hands externally. But we believe that in many cases the dorsal posture will lend the greatest facility.

We must apply pressure to the uterus towards the median line of the mother, both at its fundus and at the lower part, which contains the head. The head will thus be pushed by one hand to the right, whilst the fundus uteri is pushed by the other hand to the left.

If labour have begun, we may combine internal with external manipulation. We may press upon the fundus with one hand, whilst with a finger in the os uteri we pull this over the centre of the brim. External pressure by a pad laid in the hollow of the ilium in which the head lay will aid the manœuvre. Then, having got the head into the proper position, whilst it is kept so by an assistant, rupture the membranes. The contraction of the uterus tends to restore its natural ovoid shape, and will also tend to keep the child's long axis in due relation. If by this contraction the head should happily become fixed in the brim, the manœuvre has succeeded; the labour has become

natural. But if the head still show a disposition to recede, it should be grasped at once by the forceps, and held in the brim until it is sufficiently engaged to be safe.

4. The mode in which forehead- and face-presentations

- 4. The mode in which forehead- and face-presentations arise out of excess of friction or resistance encountered by the occiput, and the way of restoring the vertex to its right position, have been described (see p. 184).
- 5. Descent of the hand by the side of the head. When this accident occurs it is apt to proceed to shoulder-presentation, the hand and arm slipping down and wedging the head off the brim to one or other iliac fossa. Hence the importance of correcting this complication as early as possible. Whilst the parts are still movable it is commonly possible to push up the presenting hand by means of one's left fingers in the vagina; and at the same time, by pressing down the head by the external hand towards the brim, the head is made to fill the space until the forceps is applied. Then, drawing the head into the brim, the hand cannot again descend.
- 6. Prolapse of the umbilical cord by the side of the head may sometimes be managed successfully in a similar manner to that described above for the hand, having first replaced the cord above the head. But there are other forms of prolapse of the cord which call for more detailed description.

The causes which lead to prolapse of the cord are generally those which favour the production of malposition of the child, such as pelvie distortion, placenta prævia, excess of liquor amnii. All causes that hinder the complete filling of the lower segment of the uterus and the pelvic brim by the presenting part of the child of course leave room for a loop of cord to fall through. The cord is especially apt to be hooked down if it be over-long, if it take its origin near the orificial zone of the uterus from the lower margin of the placenta; and if there be a sudden rush of liquor amnii when the membranes burst the cord is apt to be swept down with the stream.

One thing deserves attention. Prolapse of the eord has frequently happened when the patient has been sitting or standing up at the time the membranes have burst. Hence it is desirable to keep the patient on her bed when this event is expected; and then, should the funis come down, the accident may be detected at the earliest moment—a point of paramount

importance. The pressing indication is to rescue the child from the danger of perishing by asphyxia.

There are two periods of prolapse. The management varies accordingly. The first case is when the cord is felt below the presenting part of the child whilst the membranes are still entire. Hitherto the risk of pressure upon the cord is small. It is rarely necessary to interfere before the membranes burst. But when the cord is felt through the membranes we must be prepared for the coming event, and also for the probability of some other part of the child than the head presenting. The moment the membranes burst, the cord will probably be carried down by the torrent of liquor amnii. If the cervix uteri be freely open at the moment of bursting, the condition will be so far favourable for immediate efforts to replace the cord or to deliver promptly; but should the ccrvix be only moderately open the risk is greater. In this case we should do well to dilate the cervix before the membranes burst by the waterbags, so as to ensure freedom for manipulation. We must be ready to act according to the indications of danger to the child and the presentation.

ready to act according to the indications of danger to the child and the presentation.

Since, during the passage of the child, the prolapsed cord must undergo protracted compression, the child's life is in invariant danger.

Passage will depend upon one of two condi-

imminent danger. Rescue will depend upon one of two conditions: first, upon reposition of the funis above the presenting part of the child, and its retention there; or, secondly, upon the speedy delivery of the child before fatal asphyxia has occurred. Sometimes we have a choice in the method of proceeding; sometimes the course of action is imperatively dictated by circumstances. For example, if there is a shoulder-presentation there is obviously a major reason for turning. If there is placenta prævia, with profuse hæmorrhage, to secure the safety of the mother must be the first object. For this, turning may be indicated; indeed, that which is best for the mother often gives the chance for the child also. In the case where the cord springs from the margin of the placenta, and this margin descends to near the orifice of the womb, it is clear that there is not much hope of keeping up the cord, even if we succeed in putting it back into the uterine cavity; the next pain will expel it again. The prospect of saving the child depends upon prompt delivery. If the head present, it is best to put on the forceps at once; if the os is not sufficiently dilated, apply the water-bags; or, if it appear that delivery can be effected more quickly by turning, adopt this operation.

If there be contraction of the conjugate diameter of the pelvis, so that the cord slips down on one side of the promontory where the brim cannot be blocked by the head, we may try to replace the cord before proceeding to deliver. The same thing should be tried when there is no deformity, and when the cord springs from the higher zones of the uterus.

As to the modes of reposition of the cord. We may occasionally—rarely, it is true—take the prolapsed loop in the fingers of the left hand, and, in the absence of contraction, carry it up into the uterus above the presenting head, and even hang it over the child's knee or foot. Unless we succeed in thus finding a peg for it, it will almost certainly follow the hand down again as we withdraw it. And whenever we have succeeded in carrying the cord into the uterus, we must immediately try to fill up the pelvic brim with the child's head. This may be done sometimes by external pressure with the hands, or better still by the forceps. When the cord comes down in breech- or feet-presentation, we may do as Wigand did—carry up the cord with the hand, and immediately bring down a leg into the os uteri.

Another mode of replacing the funis is by help of the so-called knee-elbow posture. Thus, the pelvis is raised above the level of the fundus of the uterus, and not only gravitation, but a suction force of the abdominal cavity, are brought into aid. But, even here, the forceps must be used to bring the head into the pelvis. This plan was taught by the late Dr. Bloxam, when Robert Barnes was house-surgeon under him at Queen Adelaide's Lying-in Hospital, forty years ago. It has since been enforced and successfully applied by Thomas, of New York, under the name of the Postural method (1858), by Theopold (1860), by Wilson of Glasgow (1867), and others.

We may, by help of this posture, succeed by the hand alone. But a special instrument to replace cord may be useful. A multitude of instruments have been invented. None surpass in simplicity and effectiveness the contrivance of Roberton. This is a long flexible rubber catheter of large calibre mounted on a stilet, with a large eyelet-hole near the

blind end. Fig. 91 represents the tube in action. A loop of coarse soft silk or worsted is carried through the tube and out at the eyelet, or a loop of worsted may be tied upon the end of the catheter. The prolapsed cord is caught in the loop. The tube is then carried by the stilet past the presenting part of the child until the cord is fairly lodged in the uterus. Then, applying a finger of one hand to the lower end of the tube, the stilet is withdrawn, leaving the tube and cord in situ.



Fig. 91.—Showing Reposition of Prolapsed Cord in Knee-elbow Posture. (R. B.)
Roberton's tube carries the cord above the head to A. The stilet is then withdrawn, and the tube left in situ.

The tube will come away with the placenta when the child is born.

If the cord is flaccid and pulseless, especially if the prolapsed loop is cold, and if tickling the child's feet excites no reflex movement, it may be presumed that the child is dead. But it is proper to auscultate the abdomen; and, if the hand is passed into the uterus, we should take the opportunity of feeling the child's chest for the heart-beat. If the child is known to be dead, the indication is clear to turn our attention exclusively to the interest of the mother.

Allied to prolapsus is the entanglement of the cord round the child's neck. The cord being perhaps of excessive length, and the child's head being prevented from filling the lower segment of the uterus, a loop of cord lodges there, so that when the eervix opens the bead passes through the loop. This is the most common mode of production. But it may occur before labour under spontaneous version. The child commits suicide by hanging. Occasionally two, or even three, coils are found round the neck. The effect of this accident is that, as the child descends through the pelvis, the cord tightens round the neck, tending to strangle it. The labour is likely to be arrested from the child being held back by the cord dragging upon the uterus.

It is a good rule in ordinary labour, the moment the head is born, to pass the finger round the neck to feel if the cord encircles it. If it is found loose and the body is advancing, so that you have no time to bring the loop over the head, open the loop and let the child's body pass through it. But if the head is not advancing, if it be observed that after every pain the head seems to be retracted, if there is unusual uterine pain, and especially if the child's face is becoming congested and the cord is felt tight and pulseless, not a moment should be lost in passing a finger under the cord and severing it. Then accelerate the birth of the child, and tie the cord at the usual distance from the navel. If it be feared that the child may bleed, both ends of the divided cord may be tied before delivery. But this is not really necessary.

The Management of certain Difficult Breech-Labours.

The management of ordinary breech-labour has been described (see p. 194). Usually it proceeds smoothly enough under spontaneous forces. But there arise cases in which aid is necessary. The true rule in giving aid is to produce a position more favourable to delivery; and thus the manœuvres called for fall under our definition of version. Since the breech is already presenting, a great part of the end contemplated in podalic turning is already accomplished. The problem

is, so far, simpler than that of effecting complete version; and it may, therefore, logically and usefully serve as an introduction to the description of version for shoulder-presentation.

There are two principal conditions of breech-presentation under which labour may become arrested or difficult. Whether the position be dorso-anterior or dorso-posterior, the legs may be disposed in one of two ways: First—and it is the most common way—the legs may be flexed upon the thighs, so that the heels are near the nates, and—what is very important to recollect—not far from the os uteri (see figs. 31, 32, 92); or secondly, the legs may be extended so that the toes are pointed close to the face (see fig. 94).



Fig. 92.—Showing how to seize a foot, to bring it down when breech is delayed in the pelvis. The legs are flexed in normal attitude. (R. B.)

In both cases the breech represents the apex of a wedge entering the pelvis, whilst the base is delayed at the brim. The indication is to decompose the wedge. The principle of action is the same. To take the simpler case first, that in which the legs are flexed upon the thighs, the feet near the nates. In this case (see fig. 92) the manœuvre is simple and effective: bring down one leg.

The first thing to do is to determine the position of the breech in relation to the pelvis. In all cases of doubtful diagnosis it is well to pass the fingers, or hand if necessary,

well into the pelvis, so as to reach the higher presenting parts. In a breech case we thus reach the trochanters, and above them the groins, where a finger will pass between the child's body and the thigh flexed upon it. Then in front will be the fissure between the thighs; and here, if the legs are flexed upon the thighs, will be the feet to remove all doubt. These are what we are in search of. We only want one. It is much more easy to bring down one foot, and it is, moreover, more scientific. The question now comes, Which foot to bring down?



Fig. 93.—Delivery of breech by drawing down one foot. (R. B.)

The one nearest to the pubic arch is the best. To seize it, pass the index finger over the instep; then grasp the ankle with the thumb, and draw down backwards to clear the symphysis pubis. When the leg is extended outside the vulva, it will be found that traction upon it will cause the half-breech to descend and the child's sacrum to rotate forwards. The further progress of the case falls within the ordinary laws of breech-labour (see fig. 93).

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The second case—that in which the feet lie at the fundus of the uterus close to the face—is far more difficult. The wedge formed by the extended legs and the upper part of the trunk must, in some instances at least, be decomposed before delivery can be effected. The cause of the difficulty will be understood on looking at the diagram (fig. 94), and on reflecting that the breech or wedge may in great part be driven low down into the pelvis, leaving but little space for the operator's hand to pass; further, that the hand must pass to the very fundus of the uterus to reach a foot. No ordinary case of turning involves passing the arm so far.

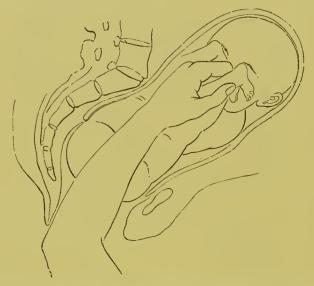


Fig. 94.—Showing how to scize a foot, to decompose the wedge formed by the extended legs and trunk. (R. B.)

The mode of proceeding is as follows: Place the patient on her left side (see fig. 94); produce anæsthesia to the surgical degree; support the uterus with the right hand on the abdomen; pass the left hand into the uterus, insinuating it gently past the breech at the brim, the palm being directed towards the child's abdomen, until you reach a foot—the anterior foot is still the best to take; a finger is then hooked over the instep and drawn down so as to flex the leg upon the thigh. Keeping hold upon the foot, it is drawn down out of the uterus, and the wedge is broken up. The main obstacle is thus removed, and we have the leg to draw upon if more vis à fronte is needed.

One eaution is necessary in performing this operation: the finger must be applied to the instep. It is of no use to attempt to bend the leg by aeting upon the thigh or knee; the fore-finger must therefore be carried nearly to the fundus of the uterus. This and the filling up of the brim, and even of a part of the pelvic eavity sometimes, by the breech, render the operation one of considerable difficulty, demanding great steadiness and gentleness. We have on several occasions brought a live



Fig. 95.—Showing the wedge decomposed when one leg is brought down. (R. B.)

child into the world by this proceeding when foreeps, hooks, and various other means had been tried in vain. For want of right appreciation of this case, the uterus has been ruptured in the vain attempt to deliver by bad methods.

This difficulty seems scareely to have been noticed in the modern text-books; some, indeed, still reproduce diagrams representing the extended legs as the usual attitude of the feetus in breech-presentations. Fielding Ould, however (1742), seems

to have elearly understood these eases. When the feet, he says, are near the outlet, 'seize them, and at the same time that they are drawn forwards the buttocks must be proportionately thrust into the womb by the fingers of the left hand; for want of this preeaution the thigh-bone of many an infant has been broken. Both legs and thighs may be extended along the child's body so as to have a foot over each shoulder, which much increases the difficulty. In this ease each leg must be taken separately and the knee bent.' But it is superfluous trouble to take both legs; one is easier and better.

It is quite excusable before proceeding to so difficult an encounter to try some other method. The child may be small and the pelvis large, and so a moderate degree of tractile force may be enough to bring the wedge through without deeomposing it. Various manœuvres have been adopted. You may hook one finger in a groin, and draw down; or, what we have found better, you may with the forefinger hook down each groin alternately (see fig. 96). In this way the breech will sometimes move, and when it is delivered, the wedge may be decomposed outside the vulva by flexing and bringing down one leg. Or a piece of tape or other soft cord may be passed over the groins, as Giffard did. An apparatus such as a flexible eatheter might be used to earry the string over the hips, after the manner adopted to plug the posterior nares for epistaxis (see fig. 96). Ramsbotham recommended the slipping a silk handkerchief over the groins. But it is very likely that these and like measures may fail; and by the extent to which they may have suceeeded in bringing down the breech, by so much is the difficulty increased. The wedging is tighter; there is nothing left but to decompose the wedge. And this, we repeat it emphatically, is the right thing to do in the first instance.

It must, however, be noted that some men of high authority advocate the use of the forceps to the breech. Certainly in some cases it answers well. Professor Harvey, of Calcutta (1884), contends that the forceps should be tried in extreme cases. Special forceps have been devised to fit the breech.

Whenever traction is made, and especially when rotation of the child on its axis is made by the operator, there is great risk of the arms hitching on the edge of the pelvic brim and running up by the sides of the head. The way of getting over this difficulty will be explained when describing version for transverse presentations. When the breech and trunk are delivered, the arms and head may follow with the aid of slight guiding force; and it is important, in the child's interest, that the slightest possible traction force be used. If, however, we feel no pulsation in the cord, and there be convulsive twitching of the legs with spasmodic heaving of the chest, there is no time to lose; the delivery must be accelerated. This may be

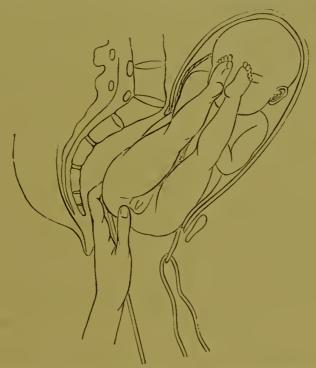


Fig. 96.—Showing how to deliver breech, legs extended, by passing a tape round the thighs. (R. B.)

done in one of two ways: First, we may hook two fingers of one hand over the shoulders, whilst, the other hand holding the legs, we exert traction in the direction of the axis of the pelvis; but if this manœuvre do not succeed readily, it is better to use the forceps in the manner described (see p. 610) on the application of the forceps to the after-coming head.

Difficult Twin-labours.

Amongst the most puzzling cases requiring operative interference are certain cases of twins. The ordinary history of

twin-labour has been sketched (see p. 225). Commonly, as we have seen, the embryos are lodged each in its own bag of amniou and chorion (see fig. 41, p. 226), and are so packed that when labour occurs one presents at a time in the pelvic brim and traverses the pelvis before the other fruit-sac is ruptured. Thus the fœtuses do not get iu each other's way.

The labour is apt, however, to be lingering from over-distension of the uterus, and the birth of the second child may be delayed. The advance of the first child is apt to be slow, because the driving force has to be transmitted through the medium of the amniotic sac of the second child. Whether we suspect twins or not, the indication for the foreeps to deliver the retarded head in the pelvis is clear. A very little vis à fronte may be enough. Then comes the question, what to do with the second child. Shall we expedite its delivery, or leave it for the natural power to expel? When expectation has been the course adopted, hours, even days, have elapsed before the second child was born. Want of power is the usual cause of delay; the nerve-store has been exhausted in the effort of delivering the first child. Want of power is a eogent reason for giving help; it is not wise to leave an inert uterus and an exhausted system to struggle alone. David Davis frequently saw flooding ensue in the practice of those who waited after the birth of the first child. The judicious course is to allow a moderate time, say half an hour, for the system to rally from the first labour, and then to help the second labour. Immediately after the expulsion of the first child, apply the binder firmly to support the uterus. If the membranes bulge through the os uteri, rupture them, and at the same time increase the pressure on the fundus uteri. If effective uterine action arise, let the uterus do its work; but if deficient, apply the forceps if the head present. Be careful to follow down the child by external pressure, squeezing the child out, as it were.

When the embryos are both lodged in the same sac—that is, in one common chorion and amnion—awkward complications may arise. Before or during labour the limbs and heads may become so entangled or locked as to form one mass, which is too large to pass through the pelvis. The embryos may perform the most remarkable evolutions; cases have been known where

one embryo has dived through a loop in the other's umbilical cord, and knots have been formed involving the two cords.

The most common form of locking occurs through the hitching of one head under the chin of the other; and this may happen whether both children present head-first, or one by the breech, the other by the head. The latter case appears to be the more frequent. A child appears by the feet or breech; and when born as far as the trunk or arms, it is found that the labour does not proceed, and on making traction to accelerate delivery, unexpected resistance is felt. You pull, but the child sticks fast in the pelvis. The first suspicion is, probably, that the head is too large, or that the arms have run up by the sides of the head, wedging it in the brim. You liberate the arms and pull again, and still the head refuses to move. Reuewed examination is now made. We may get information iu two ways: First, under anæsthesia, pass the left hand into the pelvis, so as to reach above the child's breast, feeling for its chin or mouth. Instead of feeling this first, we may be surprised at meeting a hard, rounded mass (see fig. 97) jammed in the neck and chest of the presenting child, which can hardly be anything else than the head of another child which has got in the way. Secondly, by external palpation we may succeed in making out through the abdominal wall the head of a child above the symphysis pubis, inclined to one or other side, in a position which its relation to the trunk partly born, and to the head which we have felt whilst exploring the interior of the pelvis, will satisfy us is the head of the first child. Further palpation will trace the trunk and breech of the second child.

If the children are small they may, with more or less difficulty, come through the pelvis together in this fashion. Sometimes it has been possible to seize the second head by the forceps, and to extract it without disturbing the first child. But if the children be at all large, this proceeding is not likely to save them. The pressure to which both must be subjected is too hazardous; even with children below the average size, the head of the second resting on the chest and neck of the first form a wedge too large to clear the brim. We get the state of things represented in fig. 97. D is the apex of the wedge driven into the pelvis; E C is the base too large to enter; A is the point at which the wedge may be decomposed.

The problem before us is how to extricate one head from the other so as to allow one child to pass at a time. There are several methods of accomplishing this. But before deciding upon one, it is well to study how the children are affected by the complication. Is one child in greater jeopardy than the other? If so, which? If we find that the situation involves

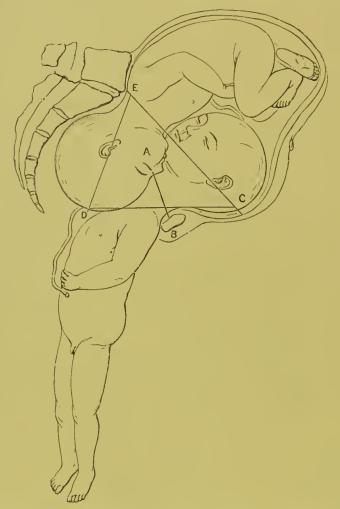


Fig. 97.—Showing Hitching and Wedging of the Heads in Twin-labour. (R. B.)

extreme peril or death to one child, we shall not hesitate to mutilate this one, if by so doing we secure or promote the safety of the other.

1. The first thing to try is to disentangle the heads without mutilating either child. It is still possible that both may be

born alive. The patient being anæsthetic, the operator presses back the trunk into the pelvis as much as possible, so as to lift the two heads off the brim, and so to loosen the lock. Then by external manipulation, aided by a hand in the pelvis, we try to push the heads apart in opposite directions. If we succeed in unlocking them, the head of the second child is held out of the way, whilst the operator or an assistant draws down the body of the first child, and engages its head in the pelvis. If this be accomplished the difficulty is over.

2. Experience shows that the first child, whose trunk is partly born, encounters by far the greater danger. Its umbilical cord is likely to be compressed; its neck and chest are forcibly squeezed. On the other hand, the cord of the second child is comparatively safe, and the pressure upon its neck is less severe. We may, moreover, find by feeling the cord of the first child that it is pulseless and flaccid; that tickling its feet excites no reflex action; and the finger on the chest may feel no heart-beat. Having thus determined that there is but faint or no hope for the first child, we turn to the best means of rescuing the second. We may decompose the wedge formed by the two heads by detaching the head of the first. This is done by drawing the body of the first child well backwards, so as to bring its neck within reach. Held in this position by an assistant, the fingers of the left hand are passed into the pelvis so as to hook them over the neck and serve as a guide to Ramsbotham's or Braun's decapitator, or the wire-écraseur. If these are not at hand, the task can be accomplished by strong scissors (see fig. 97). A B represents the line of decapitation.

As soon as the neck is severed, the trunk will be extracted by traction easily enough. The loose head will then slip up or on one side, or can be made to do so by passing the hand inside the uterus. If the head of the second child do not descend by the spontaneous action of the uterus, it may be seized by the forceps, or we may seize a leg and turn. The head of the first child will follow last of all. If it offer any difficulty it may be dealt with in the manner described hereafter in the section: 'How to deal with the detruncated head left in utero.'

3. If there be reason to conclude that the child is dead, it would be justifiable to perforate its head, and lessen its bulk by help of the crotchet. This is another mode of breaking up the

base of the wedge. The head will then flatten in and permit the trunk and head of the first child to be delivered.

In the case of head-locking (see fig. 98), where the head of the first child presents and gets locked by the head of the second, a similar rule of action will apply. The heads may be disentangled by external and internal manipulation. Failing this, we may seize the foremost head by the forceps, and whilst an assistant pushes away the second head, we can extract the first child. A good case in which this plan succeeded is related by Graham Weir.¹

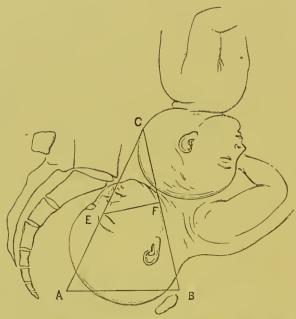


Fig. 98.—Showing Head-locking, both presenting head-first.

A. Represents apex of wedge. B.C. The base. E.F. The line of decomposition of wedge by removal of the upper head.

Another rule should be observed. When the first child is born, do not pull upon the cord, or you may do mischief in two ways. It is possible that the cord may be entangled round the neck or a limb of the child in utero, or the cord of the child in utero may be entangled in it, so that by pulling on the first cord you may strangle the second child, or arrest the circulation in its cord; or you may detach the placenta prematurely, thus giving rise to hæmorrhage; and in the probable

event of the placenta being united or common, again imperilling the child in utero. It is better if the cord becomes tight, so as to drag on the umbilicus, to divide it without attempting to tie the cut ends.

Dorsal or nuchal displacement of an arm.—Sir James Simpson and Cazeaux drew attention to a curious cause of dystocia. An arm may slip up and become locked behind the neck (see fig. 99). As the difficulty is to be met by altering the position of the displaced limb, it comes under our definition of turning.



Fig. 99.—Nuchal Displacement of the Arm. (R. B.)

This displacement most commonly occurs in cases of podalic or breech labour, as after turning. We are inclined to think that it is most frequently produced by unskilful manipulation. It is a consequence of the error of rotating the child upon its axis during extraction. The trunk revolving under this manipulation, the arm is caught against the wall of the uterus, and under excess of friction does not move round with the trunk, but comes to be applied to the nape of the neck. Dugès and

Cazcaux explain that this may happen in two ways. First, the arm may cross behind the nucha after having been raised above the head; the crossing then takes place from above downwards. and from before backwards, relatively to the fœtus. Secondly, it may take place from below upwards, the arm rising on the back of the fœtus, and being arrested below the occiput. The arms are habitually placed by the sides of the chest. rotating, the attempt is made to carry the abdominal aspect of the child towards the loins of the mother; the trunk alone moves; the arm, therefore, remains behind; the operator in performing extraction draws the trunk down; the arm is caught by the symphysis pubis, where it is detained until the nucha comes down to clench it. This displacement, therefore, is produced by too much diligence. Those who anticipate Nature, thwarting her operations, must be prepared for the consequence.

Let us extract light from our error. We must retrace our steps. By rotating the child back in the contrary direction so as to restore the original position, we may possibly liberate the arm. At any rate, further necessary proceeding will be easier. Carry the trunk backwards so as to give room to pass the forefinger in between the symphysis and the child's shoulder; then hooking on the elbow, draw this downwards and then forwards. It may be useful as a preliminary step to gain room by first liberating the other arm.

If the arm cannot be extracted it may be necessary to perform craniotomy.

In Simpson's case the head presented. It is not easy to imagine how the hand of a living child can get behind the neck when the head presents. Simpson suggests that this occurs more frequently than is suspected, and that it accounts for many cases of arrest of the head where there is no disproportion, and which resist even traction by forceps. He recommended to bring down the hand and arm forward over the side of the head, converting the case into one of simple presentation of the head and arm. Or recourse might be had to turning, as was done successfully by the late Jardine Murray.¹

Dystocia from excessive size of the abdomen of the fatus. This may happen from dropsy, from enlarged kidneys or liver.

¹ Med. Times and Gaz., 1861.

In some of these cases the abdomen may burst, or be originally defective, so that the intestines will prolapse. Such a condition, if not produced deliberately by the surgeon, may puzzle extremely. The procident intestines may be taken to be those of the mother, and lead to the conclusion that there is rupture of the uterus. Or, on the other hand, where there has actually been rupture of the uterus or vagina, with protrusion of intestines, these may, under circumstances disturbing the surgeon's judgment, be assumed to belong to the child, and be cut away.

The case is diagnosed presumptively, if the head presents, by the arrest of labour, the head refusing to yield under traction by forceps. After reasonable trial in this way, to avoid exhaustion on the part of the mother, or rupture, craniotomy becomes necessary. Even then the delivery is arrested. Then passing the hand into the uterus, the child's abdomen, distended beyond measure and giving the feel of a large tense sac containing fluid, the real obstacle is determined.

We may then puncture its abdomen with a long trocar, or even rip it open by the crotchet. The easiest way to deliver after this is to bring down the feet.

If the breech or feet present, the diagnosis and treatment care easier. Pulling on the legs causing no advance, the hand passed into the uterus ascertains the nature of the case. Puncture quickly reduces the obstacle. We have been called to cases of both kinds.

Dystocia from Monsters.

It is convenient in this place to consider the mode of delivery of monsters. Double monsters may give rise to difficulties like those which occur in delivery of twins. In many cases, Nature is able to deal with them. They are most frequently dead or possessed of little vitality, a circumstance not usually much regretted. The death is often the result of the mode of birth, one part of the monster pressing injuriously upon another. If in any case of obstructed delivery it could be with certainty diagnosed that the cause of obstruction was a monstrous embryo, the indication commonly accepted to do our best to save the mother, even at the cost of destroying

the embryo, is enhanced. But this cannot always be known in time to influence our proceeding. As in the case of locked twins, we are therefore led to postpone mutilation, in the hope that the delivery may be effected without.

Playfair has discussed this subject in an excellent memoir. He divides monsters, according to their obstetric properties, into four classes:—

A. Two nearly separate bodies are united in front by the thorax, or abdomen. In this case the feet or heads may present. The most favourable presentation appears to be the feet. The trunks come down nearly parallel. The arms can be liberated without much trouble. It is when the heads come to the brim that the difficulty arises. The object is to get one head at a time to engage in the brim. This has been done successfully by Drs. Brie and Molas.² When the shoulders were born, the bodies were carried strongly forwards over the mother's abdomen. This manœuvre has the effect of placing the two heads on a different plane, bringing the posterior head lower than the anterior one, which for the time is fixed above the symphysis. When the posterior head is in the pelvis, traction then will bring it through, and the second head will follow. If not, either the first or second head can be detruncated by Ramsbotham's hook, or by scissors or knife. The command thus obtained over the course of labour in podalic presentations renders it desirable to turn if the heads present.

But sometimes when the heads present, accommodation takes place, which permits them to pass without mutilation. Thus Mr. Hanks reports ³ a case in which one head got packed between the shoulder and head of the other body, so that both passed without great difficulty. One head is born first, either by aid of forceps or spontaneously, and the corresponding body may be expelled by a process of doubling-up, or spontaneous evolution. If this does not proceed with sufficient readiness, decapitation or craniotomy of either the first or second child must be practised.

B. Two nearly separate bodies are united nearly back to back by the sacrum, or lower part of the spinal column. In this case the mode of delivery is essentially the same as in A.

¹ Obst. Trans., vol. viii. ² Bull. de la Faculté de Méd., vol. iv. ³ Obst. Trans., vol. iii.

- C. Dicephalous monsters, the bodies being fused together. One head will come down first. The body follows by doubling or spontaneous evolution. If this does not take place, decapitate the first head and bring down the feet.
- D. The bodies are separate below, but the heads are partially united. Whether the head or feet present, if there is obstruction, it is best to perforate the head.

Labour with single monsters, especially the acephalous monsters, is not only at times puzzling but is apt to be protracted. The diagnosis is apt to perplex. We are not accustomed to feel a head divested of cranial bones. The labour is generally protracted. Hæmorrhage is likely to complicate. The protraction is due to the absence of a fully-developed skull. As the uterus presses upon the child the body doubles up itself, the back of the neck becoming the presenting part. In fact an acephalous fœtus acts like a dead fœtus in retarding labour. The forceps may serve, but turning will generally be preferable.

The varieties of monsters are described by Noble Smith in the first volume of this work. In labour, they may simulate almost every complication. Tumours as big as the head itself may be attached to the head or sacrum. The limbs may be louble or truncated. Such anomalies may defy diagnosis before or during labour.

Hernia, femoral or inguinal, complicating pregnancy may not seriously obstruct the progress of labour, but may prove a source of danger to the mother. A coil of intestines might get compressed against the pelvis by the descending child. A similar danger might also result from vaginal hernia. Reduction should always be effected during pregnancy. The same observations apply to umbilical hernia. This generally results from the separation of the recti muscles in a former labour, or from the widening of the scar after ovariotomy. A well-adapted abdominal belt should be worn during pregnancy and labour to compensate for the deficiency in the normal support and action of the abdominal muscles, as well as to guard against the protrusion and injury of the intestines.

Podalic Bi-polar Turning.

The conditions indicating this operation are: 1. Generally those which are not suited for head-turning, or for the imitation of spontaneous evolution. 2. Especially those cases of oblique presentation, in which the breech, knees, or feet are nearer to the os uteri than is the head. 3. Cases in which the shoulder has entered the brim of the pelvis, and especially those in which the arm is prolapsed. 4. Most cases in which the cord is prolapsed with the arm or hand, and cannot be returned or maintained above the presenting part of the child. 5. Cases of shoulder-presentation in which the liquor amnii has drained off, and in which the uterus has contracted so much as to impede the mobility of the feetns. 6. Certain cases in which it is desirable to expedite labour on account of dangerous complications, present or threatening: as hæmorrhage, accidental or from placenta prævia; convulsions. In these cases it is indifferent what the presentation may be. But the forceps would be preferred if promising equal expedition. 7. Some cases of inertia, the head presenting, as in pendulous belly and uterus, where the head cannot be grasped by the forceps. 8. Certain cases of face-presentation. 9. Certain cases of minor contraction of the pelvis, which are beyond the power of the forceps, and which ought not to be given over to craniotomy. 10. Certain cases of morbid contraction of the soft parts. 11. As a part of the proceedings for the induction of premature labour, in certain cases in which the pelvis is contracted, or other circumstances do not permit the spontaneous passage of the child with sufficient quickness to secure a live birth. 12. Some cases of craniotomy, as the readiest mode of extracting the feetns. 13. Certain cases of rupture of the uterus, the child being still in the uterine cavity. 14. Certain cases of monstrosity of the feetns. 15. Certain cases of dystocia from tumours encroaching on the pelvis. 16. Certain cases of death of the mother during labour, in the hope of rescuing the child, when the Cæsarian section cannot be performed.

It is thus seen that version has a wide range of application, and that in a considerable number of instances it stands between the forceps and craniotomy, being in some cases competitive or

elective in relation to these two operations, whilst it has a large field of its own.

In artificial podalic version we take as our guide, and seek to imitate, the spontaneous podalic version. We now examine the conditions favourable to this operation. These are:

1. The pelvis must be capacious enough to permit the passage of the fœtus without mutilation.

2. The vagina and vulva must be dilated, or dilatable enough to permit the necessary manipulations on the passage of the child.

3. The pelvis must not be too crowded with the child.

4. The uterus must not be contracted to such an extent that the fœtus has been in great part expelled from its cavity, so that the presenting shoulder or head cannot, without undue force, be pushed on one side into the iliac fossa.

If the shoulder is free above the brim, the hand not descended, it will be easy to push it across to the nearest iliac fossa. If the shoulder is movable, even if the hand has fallen into the vagina, the operation is practicable, often not even difficult. The presence of a little liquor amnii is a manifest advantage, since, so long as this is the case, there can be no balling or impaction.

If, on the other hand, the shoulder has been driven low down into the pelvis, near the perinæum, the body being firmly compressed into a ball by the spasmodic contraction of the uterus, the child is almost certainly dead, and turning may be difficult or impossible without extreme danger to the mother. This is a strong indication for imitation of the process of spontaneous evolution.

The operation. It is convenient to take first the more simple order of cases in which turning is indicated on account of conditions involving danger to the mother, as hæmorrhage from placenta prævia, the head presenting, and the cervix uteri sufficiently dilated. A case of this kind—the forceps not being preferred—requires complete turning, and therefore best illustrates the mechanism of the bi-polar method.

We must, in limine, distinguish between turning and extraction. We will assume a case in which both proceedings are necessary.

Each proceeding may be divided into stages or acts. The successive acts in turning are: 1. The removal of the presenting

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part of the child from the os uteri, and the immediate placement there of the knees. 2. The scizure of a knee. 3. The completion of version by the simultaneous drawing down of the knee and the elevation of the head and trunk. These three acts complete turning.

The several acts in extraction are: 1. The drawing the legs and trunk through the pelvis and vulva. An incidental part of this act is the care of the umbilical cord. 2. The liberation of the arms. 3. The extraction of the head.

Preparatory measures. The bowels are emptied by enema. The catheter is passed. Anæsthesia is induced if difficulty is anticipated; but in the simpler cases of bi-polar turning it is not an essential condition. Where there is any disposition to convulsion, we prefer nitrite of amyl. The patient lies on her left side, the nates brought to the edge of the bed; the pillows are removed so that the head and shoulders fall to the same level as the nates. The head is directed towards the middle of the bed, so that the operator's arm may not be twisted during manipulation; the knees are drawn up; and the right knee is held up by an assistant, so as not to obstruct or fatigue the operator's right hand, which has to pass between the thighs to work on the surface of the abdomen.

To facilitate the passage of the hand is the first object. The hand is opposed—first, by the muscles of the vulva and vagina, the levator ani, and the sphineter. These contract spasmodically when the attempt is made to introduce the hand. Secondly, the cervix uteri may oppose in like manner. The difficulty is overcome by anæsthetics and by free lubrication with carbolised vaseline or oil. In some of the simpler cases under discussion, it is not even necessary for the hand to pass the vulva. Two fingers reaching the presenting part are enough.

The state of the cervix has to be considered. It is one of the natural consequences of a shoulder presentation that the cervix is but rarely found dilated enough for turning and delivery until after, perhaps long after, the indication for turning has been clearly present. A shoulder will not dilate the cervix properly. The same may be said of many cases where turning is indicated by danger to the mother, as from convulsions or hæmorrhage. To wait for a well-dilated cervix might be to wait until the child or mother is dead. It follows,

therefore, that we must be prepared to undertake the operations at a stage when the cervix is imperfectly dilated.

What is the degree of dilatation necessary? If the question be simply one of turning, it is enough to have a cervix dilated enough to admit the passage of one or two fingers only. But since the ulterior object is delivery, with the birth of a live child if possible, we must have a cervix dilated enough to allow the trunk and head of the fœtus to pass without much delay. The modes of dilating the cervix have been described (see fig. 67, p. 530). The object is attained chiefly by the hydrostatic bags, or by the hand. The bags are much to be preferred. The hand cannot effect the dilatation so gently, and it is apt to get cramped, and lose its delicacy of touch.

The average obstetric hand will easily transverse a cervix that is too small to allow the head to pass, so that after all, even in head-last labours as in head-first labours, the head must generally open up the passages for itself.

The presence of liquor amnii is a matter of accident. If any be present, so much the better. It is needless to say that the fœtus will revolve more easily if floating in water; but it must not only revolve, we have to seize a limb. At some time or other, therefore, the membranes must be ruptured. What is the best time to do this? If we are proceeding to turn by the old method—that is, by passing the whole hand into the uterus before seizing a foot—it is an advantage to follow the plan recommended by Peu, of slipping the hand up between the uterine wall and the membranes until you reach the feet, and then to break through and seize them. During this proceeding, the arm plugging the os uteri retains at least a portion of the liquor amnii, and on drawing down the legs the body revolves usually with perfect facility.

But if we are proceeding to turn by the bi-polar method, with a cervix perhaps imperfectly opened, the membranes must be pierced at the os uteri. In this case you may, perhaps, accomplish the first act in version, that of removing the head or shoulders from the brim, and of bringing the knees over the os whilst the membranes are intact. This can be tried first, only rupturing the membranes when we are ready to seize the knee. But sometimes excess of liquor amnii imparts too great mobility to the child. The moment we touch the child it

bounds away as in *ballottement*. In such a case it is better to tap the membranes first, and allow a part of the liquor annii to run off. Whilst doing this, the finger is kept on the presenting part to ascertain how its position and mobility are affected by the escape of the water and the contraction of the uterus, so as to seize the right moment for proceeding.

It is of great importance to use the left hand for the internal part of the operation. It is a case in which ambidexterity is eminently required. The left hand in most people is smaller than the right. The patient lying on her left side, it follows the curve of the sacrum more naturally than could the right. It assists the right hand working outside, the two working consentaneously, involving no awkward or fatiguing twisting of the arms or body.

The first act. Introduction of the hand. Bring the fingers together in the form of a cone; pass in the apex of this cone, gently pressing backwards upon the perinæum, and pointing to the hollow of the sacrum. If the presenting part is fairly reached by the tips of the fingers, without passing the hand into the vagina, this may be enough, but most frequently the whole hand must be introduced. We assume the case to be one of head-presentation, since this involves complete version, the proceeding we want to illustrate. The tips of the fingers are passed through the os uteri to the presenting part. We then ascertain to which side of the pelvis the occiput is directed, for it is to that side that we must send the head. At the same time, an assistant holding up the woman's right knee, the right hand is spread out over the fundus uteri, where the breech is. Now begins the simultaneous action upon the two poles of the fætal ovoid, the fingers of the hand inside pressing the headglobe across the pelvic brim towards the left ilium, the hand outside pressing the breech across to the right side and downwards towards the right ilium (see fig. 100). The movements by which this is effected are a combination of continuous pressure and gentle taps with the finger-tips on the head, and a series of half-sliding, half-pushing impulses with the palm of the hand on the breech. Commonly, we may feel the firm breech through the abdominal walls under the palm, and this supplies a point to press against. A minute sometimes, seldom much more, will be enough to turn the child over to an oblique, or

nearly transverse, position, the head quitting the os uteri, and the shoulder or chest taking its place. It is important at this juncture to keep the breech well pressed down, so as to have it steady whilst we attempt to seize a knee (see fig. 101). This is the time to puncture the membranes, if not already broken. The fingers in the os uteri are pressed through the membranes during the tension caused by a pain, and we enter upon the second act, the seizure of a knee. Which knee to seize is the first question. The knee that effects the readiest disposition of

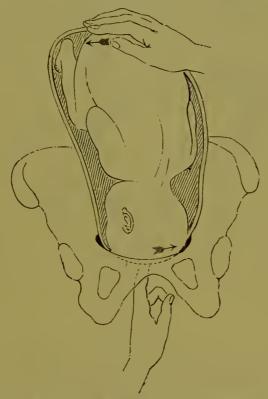


Fig. 100.—Represents First Stage of Bi-polar Pedalic Turning. (R. B.)

The right hand on the fundas pushes the breech to the right, and downwards, as indicated by the arrow. The left-hand fingers push the head to the left flinm, away from the brim.

he child's back forwards, producing a dorso-anterior position, sthe best to seize. In the case before us, the anterior knees the one best adapted to effect our purpose. Reference to he figures will show that the legs doubled up on the abdomenoring the knees near the chest, so that as soon as the head and houlder are pushed on one side the knees come near the osteri. The knee being seized, the further progress of the cases under command. By simply pressing down upon the part

seized, version may often be completed. But it will greatly facilitate the operation to apply force to both poles. It is seen in fig. 101 that the hands have changed places in relation to the two poles of the feetal ovoid. Although the left hand has never shifted its position from its part in the vagina, the ovoid has shifted. The forefinger drawing down the knee now acts upon the pelvic end of the ovoid. The right hand, therefore, is at liberty to quit this end; it is transposed to the head-end of the ovoid, which has been carried over to the left iliac fossa. The palm is applied under the head, and pushes it upwards in response to, and in aid of, the downward traction exerted on



Fig. 101.—Represents the Second Stage of the First Act. (R. B.)

The right hand still at the fundus uteri, depresses the breech, so as to bring the knees over the brim, whilst the left hand rushes the shoulder across the brim towards the left like fossa.

the child's leg. This outside manœuvre singularly facilitates the completion of version. It may be usefully brought into play in almost every case of podalic turning. If it is neglected we may fail to effect complete version, for the head will not always quit the iliac fossa by simply pulling on the legs.

The third act. Completion of version. Continuing to draw upon the leg, as soon as the breech nears the brim, a movement of rotation of the child on its long axis takes place, the end of which is to bring its back to the front of the mother's pelvis. This rotation depends upon a natural law of adapta-

tion of the two parts. It is bad practice to 'give the turns,' as some authors imagine they do. We cordially agree with Wigand when he says, 'Nature knows better than we do how to impart the proper turns.' What we have to do is simply to supply onward movement in the pelvic axis. Nature will do the rest. The leg will be felt to rotate in our grasp, and the back will gradually come forward (fig. 102).

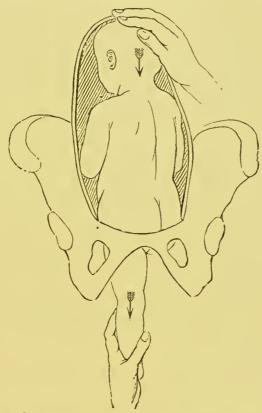


Fig. 102.—Represents Completion of Third Act of Turning, and the Beginning of the First of Extraction. (R. B.)

The right hand still supports the head, now brought round to the fundus uteri. The left hand draws down on the child's leg in the direction of the pelvic axis. The child's back has come to the front of the pelvis. If extraction is necessary, both hands work together, one for traction, the other for pushing.

This completes version. The breech is substituted for the head. Nature, aided or not by pressure on the fundus, may effect expulsion. But if she fail, we have it in our power to effect delivery by extraction. We assume that extraction is necessary, and proceed to this operation.

The operation of extraction after podalic turning, or other breech-first labour. We possess in our hold upon the leg a

security for the further progress of delivery of which we can avail ourselves at pleasure. Extraction is conveniently divided for the purpose of description into three acts: (1) Drawing down the trunk through the vulva; (2) the liberation of the arms; (3) the extraction of the head.

The first act is effected by simply drawing down upon the extended leg in the axis of the brim. Here again we must insist upon the rule to use traction simply, avoiding rotation. This is attained by holding the limb loosely in the hand, that the limb may rotate within the grasp under the rotation imparted to it by the trunk. Care must also be taken to avoid all premature attempts to direct the extracting force forwards in the axis of the pelvic outlet.

When the breech has come to the outlet, it is time to direct the extracting force a little forwards, so as to enable the hip which is nearest the sacrum to clear the periucum. This stage should not be hurried. The gradual passage of the breech has been doing good service in securing free dilatation of the vagina and vulva, an essential condition for the easy passage of the shoulders and head. When the hips have cleared the outlet, the forefinger of the left hand may be passed into the groin, and gentle extraction made by this additional hold, thus distributing the traction-force and lessening the drag upon one medium, the leg. At the same time, by pressing the knee still in the pelvis across the child's abdomen, the liberation of this leg is facilitated.

When both legs and the breceh are outside the vulva, we have acquired a considerable increase of extracting power. But it is necessary to use it with discretion, and to lessen the force exerted upon any part by distributing the force as much as possible. Thus, we first draw upon both legs, holding them at the aukles, a soft diaper interposed. Secondly, the other hand lightly grasping the thighs or the child's pelvis and exerting gentle traction. At this stage, pressure on the fundus uteri, pressing the child down, diminishes the traction-force.

Traction must now again be directed in the axis of the brim, in order to bring the shoulders through the inlet. The shoulders will enter in the same oblique diameter, back forwards, as that in which the breech traversed.

As soon as the belly comes iuto view, the eord demands

attention. The management of this point is described at p. 197. The observations of May and Wigand are important. Reasoning that the pressure suffered by the cord affects the veins more than the arteries, and hence that the access of blood to the fœtus is hindered, whilst the removal of blood from it is still obstructed, so that a fatal anæmia results, they advise to tie the cord, as soon as the child is born as far as the navel, and then to complete extraction. Von Ritgen says that when this is done there is little need to hurry extraction.

The second act comprises the liberation of the arms. In the normal position of the fœtus the arms are folded upon the breast; and if the trunk and shoulders are expelled through a normal pelvis by natural efforts, they will commonly be born in this position. But if ever so little traction-force is put upon the trunk, the arms, encountering friction against the parturient canal, as the body descends, are detained, and run up by the sides of the head. Hence often arises delay in the descent of the head. It is wedged in the brim. To avoid this complication is one great reason for not putting on more extraction-power than necessary. If, however, we find the arms in this unfortunate position, we must be prepared to release them promptly, and at the same time without injury. It is very easy to dislocate or fracture the humerus or elavicle if the proper rules are not observed.

The cases vary in difficulty, and therefore in the means to be adopted. In some eases the arms do not run up in full stretch along the sides of the head. The humeri are directed a little down, so that the elbows are within reach. In such cases it is an easy matter to slip a forefinger on the inner side of the humerus, to run it down to the bend of the elbow, and to draw the forearm downwards across the chest and abdomen, and thus to bring the arm down by the side of the trunk.

The cardinal rule in all cases is to observe the natural flexions of the limbs, always to bend them in the direction of their natural movements. The arms, therefore, must always be brought across the breast. The way to do this is as follows: Slip one or two fingers up along the back of the child's thorax, and bend the first joints over the shoulder between the aeromion and the neek; then slide the fingers forwards, catching the humerus in their course, and carrying this with them

across the breast or face. This movement will restore the humerus to its natural flexion in front of the body. The operator's fingers continuing to glide down, will reach the bend of the elbow, and, still continuing the same downward and forward movement across the child's chest and abdomen, the arm is extended and laid by the side of the trunk.

This is what has to be done. But which arm shall be brought down first? The most simple rule is to take that first which is the easiest, for when one arm is released, the room gained renders the liberation of the second arm easy enough. Generally there is most room to work in the sacrum; therefore it is better to take the posterior or hindermost arm first.



Fig. 103.—Represents the Mode of Liberating the Sacral or Hinder Arm. (R. B.)

Two principal difficulties oppose the efforts to release the arms. The first is, to bring the posterior or sacral arm within reach of the finger. To effect this, carry the child's body well forwards, bending it over the symphysis pubis (see fig. 103). The advantage gained from this is twofold. Space is gained between the child's body and the sacrum for manipulation; and as the child's body revolves round the pubic centre, the sacral arm is necessarily drawn lower down, commonly within reach. When the sacral arm is freed, reverse the manœuvre, carrying the child's body backwards over the coccyx as a centre. This brings down the pubic arm (see fig. 104).

Another manœuvre may be held in reserve, in case the first fail. To execute it, we must still bear in mind the natural flexions of the arms. The child's trunk is grasped in the two hands above the hips, and a movement of rotation is given to the body on its long axis, so as to bring its back a little to the left. The effect of this is to throw the pubic arm, which is prevented by friction against the canal from following the rotating trunk, across the chest (fig. 105). Thus the effect being accomplished so far, we bring into play the first manœuvre, and bring this arm completely down. This done, the action is reversed by rotating the trunk in the opposite



Fig. 104.—Represents the Liberation of the Pubic Arm. (R. B.)

direction. The sacral arm is thus brought to the front of the chest, and, by carrying the trunk back, the fingers will easily complete the liberation.

It is desirable to avoid this rotation, if possible; but under certain circumstances of difficulty it is exceedingly valuable. The rotation need not be considerable; an eighth of a circle is commonly enough; and as it is neutralised by reversal, an objection that might otherwise be urged is removed.

A paramount reason for caution in rotating the trunk or giving the turns' is this: The union of the atlas with the occipital condyles is a very close articulation; it permits flexion

and extension only. The atlas forms with the axis a rotatory joint, so constructed that if the movement of rotation of the head exceed a quarter of a circle, the articulating surfaces are apt to part, and then the spinal cord is compressed or torn. If the chin of the fœtus pass the shoulder in turning backwards, the result may be instant death. We have no doubt that many children have been lost in this way.

Sometimes the arm will hitch on the edge of the pelvic brim or just above the imperfectly-expanded os uteri. Never

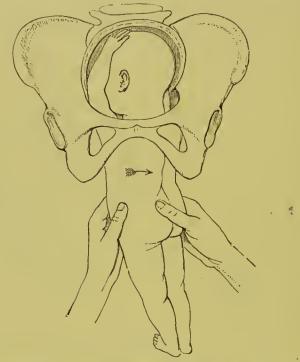


Fig. 105.—Represents a Mode of Liberating the Arms. (R. B.)

The trunk is rotated an eighth of a circle from right to left, so as to throw the left arm across the chest.

attempt, by direct hooking on the middle of the humerus, to drag it through. It would almost certainly be broken. Press it gently against the child's face, and under its chin, bringing the finger down as near the elbow as possible, so as to lift this part, as it were, over the obstruction.

The third act. The arms liberated, the extraction of the head begins. This is often a task of some difficulty, and always demanding strict observance of the laws which govern

the mechanism of labour. This act differs from the two first in that whilst these are sometimes effected by Nature, the liberation of the head must frequently be conducted by art. When the head is last, and has entered the brim, it is very much

removed from the influence of expulsive force. The uterus can with difficulty follow it into the pelvis, and the trunk, unless supported by the hands, would, by its mere vis inertice and friction against the bed, retard the advance of the head. Moreover, this is the stage of chief danger from the compression of the cord. The round head fills the brim and the cervix so that the cord can hardly escape. would be folly therefore to sit by and trust to Nature at this juncture, at the risk of losing that for which the whole operation has been performed, namely, the child's life.

First, let us assume the case of the head being in the pelvis, and that we cannot extract it at once. If we can get air into the chest, which, being outside the vulva, is free to expand, there is no need to hurry the delivery. We may sometimes get the tip of the finger into the child's mouth, and drawing this down, whilst lifting up and holding back the perinæum, air may enter the chest. In this way we have kept a child breathing for



Fig. 106.—Represents the Manual Extraction of the Head. (R. B.)

The dotted line is Carus's curve, the direction to be observed in extraction.

ten minutes before the head was born. Another plan is to pass a catheter or other tube up into the mouth, so as to give, by means of an artificial trachea, communication with the external air. But we must not put our trust in plans of this kind, lest the golden opportunity be irretrievably lost. The real problem is to get the head out of the pelvis.

There are two principal modes of doing this, whether the head be delayed in the pelvic cavity or at the brim. One is to put on the forceps. This operation, 'the application of the forceps to the aftercoming head,' has been described in the chapter on the forceps. If one is skilled in the use of the forceps, it is little inferior in celerity to the manual extraction, and it possesses the decided advantage of taking off all strain upon the occipito-cervical articulations.

We will, however, describe the proceeding by manual extraction. It must be remembered that the head has to perform a double rotation in its progress. It must revolve round the pubic symphysis as a centre; it must rotate in the cavity on its vertico-spinal axis, so as to bring the face into the hollow of the sacrum. In extracting, these movements must be respected. The fingers of one hand are forked over the neck behind, and at the same time holding the legs with the other hand, we draw down gently in Carus's curve (see fig. 106). If the body is carried forward too soon, the child's head and neck are converted into a hook or cross-bar, which, holding on the anterior pelvic wall, will effectually resist all efforts at extraction.

If the equator of the child's head has not passed the brim, the case is more difficult. Traction must be made in the axis of the brim. Sometimes it requires considerable force to bring the head through; but whilst force will never compensate for want of skill, it is astonishing how far skill will carry a very moderate force, especially if gentle oscillation and firm pressure upon the fundus uteri be made to aid traction.

Turning when the liquor amnii has run off, the uterus being contracted upon the child.

So long as there is any liquor amnii present, and often for some time afterwards, the bi-polar method as already described is more or less available. But a period arrives when it becomes

¹ In the third edition of the *Obstetric Operations* the preference is given to manual extraction. But under the advice of Fancourt Barnes, who has had the best results from the axis-traction forceps, this has been reconsidered. We concur in advising the use of the forceps.

necessary to pass a hand fairly into the uterus in order to seize a limb. The contraction of the uterus, especially concentric or centripetal, tends to shorten the long axis of the child's body. The effect is to flex the head upon the trunk, and to bend the trunk upon itself, reducing the ovoid to a more globular form, that is, to 'ball the fœtus.' The knees are thus brought nearer to the chest, but this does not diminish the difficulty of turning. Secure repose of diastaltic function by chloroform or nitrite of amyl.

The first question to determine is, which hand to pass into the uterus. The left hand is generally to be preferred. In the majority of cases the child's back is directed forwards; to reach the legs which lie on its abdomen, the hand must pass along the hollow of the sacrum, and this can hardly be donethe patient lying on her left side—with the right hand, without an awkward twist of the arm. It is scarcely necessary to point out how violent a proceeding it would be to pass up the right hand between the child's back and the mother's abdomen, to carry the hand quite round and over the child's body to seize the feet, which lie towards the mother's spine, and then to drag them down over the child's back. The child perhaps would not turn at all. To avoid this failure, the rule is to pass the hand along the inside or palmar aspect of the child's arm. This will guide the obstetric hand to the abdomen and legs. Or the rule has been stated in this way:—Apply your hand to the child's hand as if you were about to shake hands. If the hand presented to you be a right hand, take it with your right, and vice versâ.

The following rule will serve in most cases:—In all dorsoanterior positions lay the woman on her left side; pass the left hand into the uterus; it will pass most easily along the curve of the sacrum and the child's abdomen; the right hand is passed between the woman's thighs to support the uterus externally.

In abdomino-anterior positions, lay the patient on her back, and the right hand may be introduced, using the left hand to support the uterus externally. If the patient is supported in lithotomy position, the operator can manipulate without straining or twisting the body. But it is equally easy to use the left hand internally if the patient is on her back.

The exception is only indicated to suit those who have more skill and confidence with the right hand.

Turning in dorso-anterior positions (see fig. 107). Introduce the left hand into the vagina along the inside of the child's arm. The passage of the brim, filled with the child's shoulders and chest, is often difficult. Proceed gently, stopping when the pain comes on. At the same time support the uterus externally with the right hand. Sometimes we may facilitate the passage of the brim by applying the palm of the right hand in the groin to push it up. This will lift the shoulder a little out

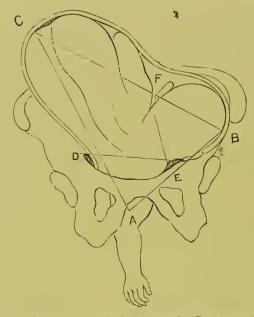


Fig. 107.—Showing a Right Dorso-anterior Position. (R. B.)

The wedging in the pelvic brim is indicated by A. Apex of wedge. B.C. Base of wedge, too large to enter brim D.E.

of the brim. Or we may adopt a manœuvre attributed to Von Deutsch, but which had been practised by Levret. This consists in seizing the presenting shoulder or side of the chest by the hand inside, lifting it up and forwards, so as to make the body roll over a little on its long axis. This may be aided by pressure in the opposite direction by the outside hand on the fundus uteri, thus getting help from the bi-polar principle.

Sometimes advantage is to be gained by placing the patient on her elbows and knees. In this posture gravity helps; the weight of the fœtus, and the lessened retentive force of the abdomen, tend to draw the impacted shoulder out of the brim.

The brim cleared, the hand passes into the cavity of the uterus. This often excites spasmodic contraction, which cramps the hand and impedes its action. Chloroform helps greatly to lessen this difficulty. The hand is spread out flat, and held still until the contraction is subdued. In its progress the hand passes the umbilicus, and the cord may fall in the way. This gives an opportunity to ascertain if it pulsates. But we must not despair of delivering a live child because the cord does not pulsate. We have several times had the satisfaction of seeing a live child born when no pulsation could be felt in utero. We are now near the arm and hand. They may perplex. But by keeping well in mind the differences between knee and elbow, hand and foot, we may interpret correctly the sensations transmitted by the parts we are touching. The most characteristic indications of the foot are the ankles and heel. At the umbilicus we are close to the knees. The feet are some way off at the fundus of the uterus applied to the child's breech.

What part of the child shall we seize? It is still not uncommon to teach that the feet should be grasped. Diagrams copied from text-book to text-book represent this very unscientific proceeding. There ought to be some good reason for going past the knees to the feet, which are further off and more difficult to get at. We know of no reasons but bad ones for taking this additional trouble. The turning can be accomplished more easily and completely by seizing one knee. Radford insisted apon seizing one foot only. A half-breech is safer than when the two feet come down. The cervix is better dilated. The circumference of the breech is from twelve to thirteen and a nalf inches, not much less than that of the head. The circumference of the half-breech, one leg being down, is from eleven to twelve inches; whilst that of the hips, both legs being down, loes not often exceed ten inches.

But a knee is better than a foot. The proper knee in these cases of impaction is that which is furthest. The reasons are admirably expressed by Sir J. Simpson. We have a right lorso-anterior position, the right arm and shoulder are downnost, these parts have to be lifted out of the brim. How can this best be done? Clearly by pulling down the opposite knee,

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which, representing the opposite pole, cannot be moved without directly acting upon the presenting shoulder. If the opposite knee be drawn down, and supposing the child to be alive, or so recently dead that the resiliency of its spine is preserved, the shoulder must rise, and version will proceed. But if both feet are seized, or only the foot of the same side as the presenting arm, version can hardly be complete, and will perhaps fail altogether. The probable effect is to drag the leg towards the brim, and to increase the wedge and the impaction. It is no sufficient answer to urge that version has been effected by drawing upon the foot of the same side. The rejoinder is that, by it, version in difficult cases is made more difficult. We are



Fig. 108.—Showing Version in Progress under the Principle of Seizing the Further Knee. (R. B.)

The arrows indicate the opposite lines of movement; how, as the further knee descends, the presenting shoulder rises.

entitled to the authority that attaches to experience when we say that, after failing to turn by this method, we have succeeded when abandoning it to seize the opposite knee.

By drawing upon the opposite knee, the movements run parallel in directly opposite directions like the two ends of a rope round a pulley. To turn effectively the child must revolve upon its long or spinal axis as well as upon its transverse axis. Turning, in short, is a resultant oblique movement, between rolling over on the side and the half-somersault. By seizing both legs, this process is marred. The only cases in which we have found it advantageous to seize both legs are those in which the

child has been long dead. Here the spine has lost its elasticity or spring. The body will hardly turn, and nothing is to be gained in maintaining the half-breech and preserving the cord from pressure. Turning effected, the process of extraction is carried out in the manner described (see p. 650).

Turning in abdomino-anterior positions does not differ essentially from turning in dorso-anterior positions. It has been shown that the best position for the patient is on her back, and that the right hand may be used. The uterus, as in all cases, is supported externally, whilst the hand is passed along the inner aspect of the child's arm, and behind the symphysis pubis; it proceeds across the child's belly to seize the opposite

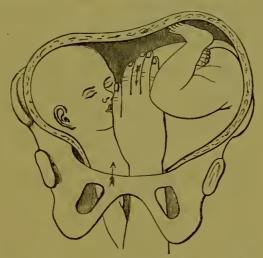


Fig. 109.—Represents Turning in Abdomino-anterior Position. Downward traction upon the further knee causes presenting shoulder to rise out of the pelvis. (R. B.)

or further knee. Drawing this down in the direction indicated n fig. 109, the shoulder rises out of the pelvis.

There is a feature in the history of turning which has not eccived the attention it deserves. Notwithstanding diligent attention to the rules prescribed, turning is not always complete. The head and part of the chest are apt to stick in the liac fossa, the trunk being strongly flexed. Complete version, is it theoretically exists in the minds of many who think they are performing the operation, is not often realised in cases where the liquor amnii has long drained off, and the uterus has noulded itself upon the fætus so as to impede its gliding round. Indeed it can hardly take place unless the bi-polar

method by combined external and internal manipulation is carefully pursued. The head may commonly be felt throughout the entire process nearly fixed in the iliac fossa, and sometimes the fore-arm remains fixed in the upper part of the pelvic cavity. The nates and trunk are delivered as much by bending and compression or moulding, as by version. The process is something between version and spontaneous evolution. The figure 110, taken from graphic memoranda made of a case which occurred to us, serves to illustrate this feature of incom-



Fig. 110.—Showing direction of Traction in Turning and incomplete Turning. (R. B.)

plete turning and the importance of the principle of drawing

upon the leg opposite to the presenting shoulder.

If the head and shoulders rise enough to permit the breech to enter the brim, delivery will not be seriously obstructed. But it not uncommonly happens, in extreme cases of impaction of the shoulder in the upper part of the pelvis, that even when we have succeeded in bringing down a leg into the vagina, version will not proceed; the shoulder sticks obstinately in the brim. In such a case the bi-polar principle must be called

into action. It is obvious that if you draw down upon the leg whilst you push up the shoulder you would act at a great advantage; but you cannot get both hands into the pelvis. Sometimes you may release the shoulder by external manipulation, pressing up the head by the palm of the hand, insinuated between it and the brim of the pelvis. In cases of real difficulty, however, this will not answer. You must push up the shoulder by the hand inside. To admit of this you pass a noose of tape round the ankle in the vagina, and draw upon this. The noosing of the foot is not always easy. To effect it you carry a running



Fig. 111.—Showing how Bi-polar Force is applied in Turning. (R. B.)

noose or bow-line knot on the tips of two or three fingers up to the foot, held down as low as possible in the vagina by the other hand. Then the loop is slipped up beyond the ankles and heel and drawn tight (see fig. 112). Often it is necessary to work with one hand only in the vagina, the hand outside holding on the free ends of the tape ready to tighten the noose as soon as it has got hold; or whilst holding the foot with one hand you may carry the noose over the foot by Braun's instrument or Hyernaux's porte-lacs. The foot being securely caught, the right hand is passed into the vagina, and the

fingers, or palm if necessary, are applied to the shoulder or chest. Now, it will be found difficult to draw upon the tape and to push upon the shoulder simultaneously. The most effective manœuvre is to pull and push alternately. Presently you will find the leg will come lower, and the prolapsed arm will rise.

In pushing the chest and shoulder, the object is to get the trunk to roll over on its spinal axis. Here, then, is an indica-

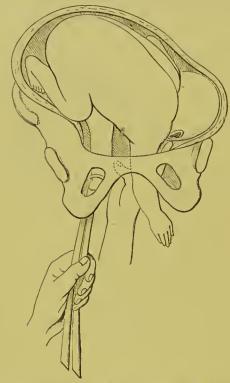


Fig. 112.—Represents the Bi-polar Method of Lifting an Impacted Shoulder from the Brim. (R. B.)

The right hand in the vagina pushes up the shoulder, whilst the left hand drawing upon the opposite foot by the tape, version is effected.

tion to execute the manœuvre of Levret and Von Deutsch. Push the shoulder and adjacent part of the chest well forwards, so as to make them describe a circle round the promontory as a centre. If we could reach and pull upon the opposite arm, rotation on the spinal axis might be effected.

Various contrivances in the form of crutches or repellers have been made as substitutes for the hand in pushing up the shoulder. The objection to them is that you cannot always know what you are doing. But the hand is a sentient instrument, informing you of what is going on and of what there is to do.

In the majority of cases of this kind we are justified in attempting to turn, because there is still a prospect of the child being preserved. But there are cases in which matters have proceeded a stage further, in which the shoulder and corresponding side of the chest are driven deeply into the pelvis, in which, eonsequently, there is marked balling of the feetus. This can hardly occur except after protracted uterine action, such as is scarcely compatible with the life of the child. Either the child was already dead at an early stage of labour—a condition, especially if the child were also of small size, most favourable to the process of spontaneous evolution—or the child has been killed under the long-continued centripetal compression of the uterus.

We have now to study how to deal with eases, mostly of impaction, beyond the resources of version, in which we have to imitate the process of spontaneous evolution.

The methods of delivery in imitation or in aid of the process of spontaneous evolution. The principal of these are:
(1) Evisceration; (2) bisection of the trunk; (3) decapitation.

In presence of such eases the question arises: Will Nature complete the task she has begun? Will the child be expelled spontaneously? A little observation will soon enable us to determine how far this desirable solution is probable, and when we ought to interpose. If the pelvis be roomy in proportion to the child, if the child be dead, small, and very flaccid, if we find the side of the chest making progress in descent under the influence of strong expulsive contractions, and if the woman's strength be good, we shall be justified in watching passively. But if we find no advance, or but very slow advance, the child being large and not very plastic, if the uterus have ceased to act expulsively, and the patient's strength be failing, her pulse rising, we must help. In what manner? This must depend upon the circumstances of the case. If a little help à fronte, to make up for deficient vis à tergo, promise to be enough, we may imitate the proceeding of Peu, who in a case of spontaneous evolution in progress passed a cord round the child's trunk to pull upon.

- 1. Evisceration. Or we may much facilitate the doubling and expulsion by evisceration. This operation consists in perforating the most bulging part of the chest, and picking out the thoracic and abdominal viscera. When this is done, traction upon the trunk by the crotchet or cranioclast will commonly effect delivery. Sometimes evisceration is insufficient, and further steps are necessary. We may choose between bisection of the trunk or decapitation.
- 2. Bisection of the trunk. This is sometimes called spondylotomy. It may be likened to breaking a bent stick in the middle, thus destroying the arc, and allowing the pieces into which the stick has been resolved to come through parallel and close to each other. This method is to be preferred when the head is retained above the brim, and access to the neck is rendered difficult by the bulging of the chest and trunk. The spine is to be divided at the most prominent part by strong scissors, by the craniotome, by a knife, or even by getting a strong cord or wire round the body and cutting through the whole body by a sawing movement. Extraction when the trunk is thus broken is generally not difficult. The base of the obstructing wedge is materially reduced, and still greater facility is gained for compression. But it may still become necessary to extract the two parts of the severed body separately. In this case we should take the lower extremity first, seizing it by the craniotomy forceps. This extracted, the other end to which the head is attached is dealt with in like manner.
- 3. Decapitation or bisection at the neck, sometimes called decollation. The recognition, or at least the application, of this proceeding is still so inadequate in this country, that we reproduce the description and illustrations of it given in the 'Obstetric Operations.' David D. Davis said ('Obstetric Medicine'): 'It may be considered a good general rule never to turn when the death of the child is known to have taken place;' and 'to decapitate in arm-presentations not admitting of the safer performance of turning.' Ramsbotham strongly advocated a similar practice. It has also been advocated and practised by l'Asdrubali (1812), Paletta,¹ by Braun, Dubois, Lazzati, and ourselves, amongst others.

¹ Del parto per il braccio, 1808.

The operation may be effected by Ramsbotham's or Braun's hook. D. D. Davis used an instrument of his own contrivance: the guarded embryotomy-knife. A plan sometimes resorted to is to carry a strong cord round the neck, and then by a sawing movement, effected by cross-bars of wood on the ends to serve for handles, to cut through the parts. The cord can be carried round by an instrument like that for plugging the nares for epistaxis, or by Dessaigne's instrument (see fig. 65, p. 620). Mattéi has designed scissors for the purpose, resembling the surgical bone-forceps. This is especially useful when it is difficult to pass a hook over the child's neck.

The operation may be described in three stages: (1) The application of the decapitator, and the bisection of the neck; (2) the extraction of the trunk; (3) the extraction of the head.

The first stage. The patient may lie on the left side or on the back. Take Ramsbotham's hook or Braun's decollator. As the instrument should be passed up over the back of the child, it is, in the first place, necessary to ascertain whether the position be dorso-anterior or abdomino-anterior. It is also necessary to determine accurately whether the fœtus is still in great part above the brim, lying transversely or obliquely, in which case the head and neek will be in one or other side; or whether, a great part of the chest having descended into the pelvis, the movement of rotation has taken place, in which case the head and neck will be found in front, near the symphysis. The next step is to get an assistant to pull down the prolapsed arm, so as to bring down the shoulder and fix it well. This brings the neck nearer within reach. Should the assistant in this duty be in the way, you may seize the prolapsed arm by a elove-hitch of tape, upon which the assistant may pull, keeping clear of the operator. The operator then passes his left hand or two or three fingers into the vagina over the anterior surface of the child's ehest until his fingers reach the fore-part of the neck. With his right hand he then insinuates the hook, lying flat, as in the dotted line in fig. 113, between the wall of the vagina and pelvis and the child's back, until the beak has advanced far enough to be turned over the neek. The beak will be received, guided, and adjusted by the fingers of the left hand. The instrument being in situ, whilst

cutting or crushing through the neek, it is still desirable to keep up traction on the prolapsed arm. In using Ramsbotham's hook, a sawing movement must be executed, carefully regulating action by aid of the fingers applied to the beak. If Braun's decollator be used, the movement employed is rotatory, and at the same time tractile. The instrument crushes or breaks through the vertebræ. Ramsbotham's cuts and saws through. When the vertebræ are severed, some shreds of soft parts may remain. These may be divided by seissors or left to be torn in the second stage of the operation.

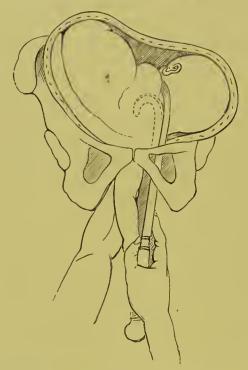


Fig. 113.—Showing First Stage of Decapitation by Ramsbotham's Hook. (R. B.)

The second stage: Extraction of the trunk. The wedge, widening above the brim, that hitherto obstructed delivery, is now bisected, divided into two lesser masses, each of which separately can readily be brought through the pelvis. By continuing to pull upon the prolapsed arm, the trunk will easily come through, the head being pushed on one side out of the way by the advancing body (fig. 114). In cases where there was difficulty in extracting the trunk, D. D. Davis used a

double-guarded erotehet, the two blades of which, fixing in the trunk, extracted like a forceps. We have never felt any difficulty in simple traction on the arm.

The third stage: Extraction of the head. The problem, how to get a detruncated head, left behind in the uterus, is not always easy of solution. In the case before us, the child having probably been dead many hours, the bones and other structures have lost all resiliency, the connections of the bones are broken down by decomposition, and the whole becomes a plastic mass, easily compressible. Such a head will sometimes be expelled



Fig. 114 —Represents the Second Stage of Delivery after Decapitation. The trunk is extracted by pulling on the prolapsed arm. (R. B.)

spontaneously, especially if aided a little by expression. We have taken away such a head by seizing it with the fingers. On the other hand, we have several times been called in to extract a head which had foiled ordinary means.

There are four methods of extraction: (1) By the erotchet; (2) by the forceps; (3) by the eraniotomy-forceps; (4) by the cephalotribe.

1. The crotchet. If the crotehet or blunt hook can be passed into an orbit or the cranial cavity, getting a good hold,

this may answer. The objection to it is the difficulty of getting a good hold, and the risk of the point slipping, and rending the mother's soft parts. The head, being loose, rolls over when an attempt is made to scize it. It is a plan to be pursued when the better means are not available.

- 2. The forceps is better adapted. If the head can be seized, which is not always easy, for it is apt to escape high above the brim, and to roll about when touched by the blades, extraction is not difficult unless the pelvis is contracted. Care must, moreover, be taken to seize the head in such a way that the spicula resulting from the severance of the vertebræ shall not drag along or injure the mother's soft parts. The seizure is greatly aided by depressing and fixing the head by pressure by an assistant externally.
- 3. The craniotomy forceps is more certain and safe. It is necessary, or at least better, first to perforate. The free rolling of the head, when pressed by the point of the perforator, tends to throw this off at a tangent, missing the cranium and endangering the mother's soft parts. To obviate this, an assistant firmly fixes the head down upon the pelvic brim by both hands spread out upon the uterus. The operator then, feeling for the occiput with two fingers of his left hand, and guided by them, carries up the perforator with his right hand, taking care that the point shall strike the head as nearly perpendicularly as possible. He then, partly by a drilling, screwing, boring motion, as little as possible by pushing, perforates the cranium. Thus the risk of the head rolling over, and of the instrument slipping, is much lessened. When a sufficient opening is made into the cranium, the craniotomy forceps is applied, one blade inside, the other outside. The blades are adjusted and locked, and traction made in the axis of the pelvis. The head commonly comes without difficulty. During extraction the fingers of the left hand keep upon the skull at the point of grasp by the instrument, guarding the soft parts from injury by spicula, and regulating the force and direction of traction.
- 4. The cephalotribe. This is the best method of all. It is applicable in cases that baffle other means. After perforation, the head, pressed firmly down upon the brim, is readily grasped, crushed down, and extracted. This method is preferable, we

think, in all cases; but it is eminently so when the pelvis is contracted.

There is still another resource, less scientific than the preceding, but one which might under certain conditions, as the want of proper instruments, be employed. It is to amputate the arms at the shoulders, so as to get more room to get at the feet and turn. But as a rule it is bad practice to amputate the arms.

Some other indications than transverse presentation for bi-polar turning. Turning is an alternative or elective operation in:

- 1. Some cases of malposition of the head or face.
- 2. Prolapsus of cord, when the cord cannot be replaced, competing with the forceps.
- 3. Descent of a hand by the side of the head, also competing with the forceps.
- 4. In some plural births to deliver the second child especially.
- 5. After craniotomy, turning is sometimes a ready way of delivering.
- 6. After the death of the mother to rescue the child, where Cæsarian section cannot be performed.
- 7. Generally, when the mother is in proximate danger, from which speedy delivery may rescue her. The principal conditions of this order are: (a) Some cases of placenta prævia and accidental hæmorrhage. (b) Some cases of urinæmic convulsions. In these chloroform or nitrite of amyl, dilatation of the cervix, and bi-polar turning offer the best means of safety.

The question in the above relations has been discussed in the sections dealing with the complications set forth.

8. The propriety of turning in minor degrees of contraction of the pelvis is a long-contested and still undecided question. To formulate a definite and precise answer which shall guide our action in every case that may come before us is impossible. We may lay down a sliding scale, such as is traced at p. 582, indicating approximately the range of contraction within which a child may be delivered with probability of safety. But we cannot often command accurate knowledge of both the principal factors in the problem. For example, we may determine nearly the condition of the pelvis; but we

cannot also determine the size and plasticity of the fœtal head, except in some cases of premature labour. The question therefore is likely to remain open for controversy. It will be often solved on what may be called subjective induction—that is, according to the operator's individual capacity, his skill in different modes of delivery, and the quality of the instruments at his command.

We may state at the outset that there are certain cases of deformed pelvis, in which turning is certainly the best both for mother and child. There are certain cases of premature labour, in which the child has not exceeded in size and hardness the capacity of the pelvis. This condition will be discussed in the chapter on the 'Induction of Labour.'

We may now consider the general question: Is turning ever justifiable as a means of delivery in labour at term obstructed by pelvic deformity? The next alternative in the descending scale of operations is a transition from conservative to sacrificial obstetrics, involving the destruction of the child; that is, if the forceps also fail. The question may be put thus: Do cases of dystocia from pelvic distortion occur in which the child can be delivered alive by turning, the forceps failing, which must otherwise be condemned to the perforator, without injury or danger to the mother? And, assuming that such cases do occur, can they be diagnosed with sufficient accuracy to enable us to restrict the application of turning to them? And if we err by turning in unfitting cases, what is the penalty incurred? How can we retrieve our error?

The extracting of a child through a contracted brim was often performed as a matter of assumed necessity, as, for example, when the shoulder presented. The observation of such cases, a certain proportion of which terminated successfully for the child, could not fail to suggest the deliberate resort to the operation in cases of similar contraction where the head presented.

Again, before the forceps was known, and before other instruments to effect embryulcia had been brought to any degree of perfection, turning was the chief resort in almost all cases of difficult labour. Thus Deventer, who wrote in 1715, as well as La Motte, declaimed against the use of instruments, and recommended turning by the feet in all cases

of difficult cranial presentation. Thus the art of turning was cultivated very successfully by some of the followers of Ambroise Paré. But it is not less certain that if children were sometimes saved, many mothers were injured or lost by attempts to turn under circumstances which are now encountered more successfully by the forceps or by craniotomy.

As instruments were improved the choice of means was extended. The forceps first contested the ground. The contest was for exclusive dominion. Chamberlen did not hesitate to accept the challenge of Mauriceau to attempt to deliver a woman with extreme pelvic contraction by his forceps, feeble and imperfect as it was. He failed ignominiously. As science advanced, the contest became better defined. Since the obstruction to delivery was due to contraction of the pelvic brim, and the problem was how to deliver a living child arrested on the brim, it is obvious that a short, single-curved forceps must in most cases fail. It was only when the long double-curved forceps came into use, that the knowledge and the power arose which enabled the obstetric surgeon to bring another means into competition with turning for the credit of saving children from mutilation.

It is, then, from the time of Smellie and Levret, who improved and used the long forceps, that the real interest of the inquiry dates. The following words, written by Smellie in 1752, challenge attention now: 'Midwifery is now so much improved that the necessity of destroying the child does not occur so often as formerly; indeed, it never should be done, except when it is impossible to turn or to deliver with the forceps.' Pugh, of Chelmsford (1754), relying on the forceps for turning, was able to say, 'I have never opened one head for upwards of fourteen years.' Perfect (1783) adopted the same practice. La Chapelle (1825) preferred the forceps. She relates that out of fifteen children extracted by forceps (long), on account of contracted pelvis, eight were stillborn, seven alive; and that out of twenty-five delivered footling, sixteen were born alive and nine dead. The percentage is in favour of the forceps. But statistics of this kind require rigorous control.

It is remarkable that it is amongst those who reject the long forceps that the strongest opponents of turning in contracted pelvis are to be found. This is the more astonishing

when we reflect that this school—not yet quite extinct—rejecting the two saving operations, has nothing to propose but craniotomy for a vast number of children that claim to be brought within the merciful scope of conservative midwifery.

At the present moment it may be said that the chief advocates of turning are those who do not realise the advantage of a good long forceps, whilst the chief advocates for the forceps are those who do use a good one. Thus it is that Stein (1773), Osiander the elder (1799), Boer, Baudelocque, and more recent authorities prefer the forceps. The late Sir J. Y. Simpson strenuously contended for turning. His forceps has, indeed, a pelvic curve, but it is really short, and quite unequal to do the work of a true long forceps.

We will now discuss the question, What is the penalty incurred, or how can we retrieve our error if we turn and fail to bring the head through the too-contracted brim? We may try the forceps to the after-coming head, and, failing that resource, we are driven to perforate after all. We shall have tried to save the child, and failed. Is the mother imperilled by this attempt and failure? This must be answered by experience. Of course the mother may suffer if we persist in dragging the child too long and too forcibly. But it is right to assume that the attempt is controlled by skill and discretion. The amount of force that can be safely endured is far greater than those who have never seen the operation would readily credit. There appears to be some saving or protective condition. This, we think, is found in the mechanism of the process. In the section on 'The Mechanism of Labour in Contracted Pelvis' from projecting promontory, we have shown that the promontory forms the centre of rotation around which the head must revolve in order to enter the pelvic cavity. The side of the head applied to this point scarcely moves at all. The promontory catches the feetal skull in the fronto-temporal region—that is, not in its greatest transverse diameter. If the coarctation be decided, the skull where it is caught bends in. Almost all the onward movement is effected by the opposite or pubic side of the skull sweeping in 'Barnes's curve' until the equator or greatest circumference has passed the plane of the brim, when the whole head slips into the cavity with a jerk. Now, injurious pressure is avoided on the pubic side by the

smoothness and flatness of the inner surface of the pelvie brim, and by a gliding movement of the soft parts intervening between the head and the bony canal. Injurious pressure on the promontory and its coverings is avoided or lessened by the yielding or moulding of the head. The temporal and parietal bones will bend in, even break. The child has been born alive after this bending and breaking. Sometimes a cephalhæmatoma forms at the point of depression. In other eases the child perishes. These latter cases go to show that the mother may bear with safety an amount of pressure which is sufficient to kill the child.

What follows? This obvious corollary: That the mother may safely bear that lesser degree of pressure which is required to bring through a living child.

The operation, then, is justified in cases of contraction that idmit of the passage of a living child. It is further justified in cases of contraction to a certain though small degree of contraction beyond this, which admits of the passage of a dead child. Beyond this, of course, it would be better not to carry the experiment. And if all the factors of the problem could be precisely ascertained beforehand, we should not go beyond this. But whilst calculating upon an average head, we may encounter one above the average in size and hardness, and thus find purselves in a difficulty. The extrication is by perforation. This is, indeed, an acknowledgment of defeat. It is beating a certain. The justification is that we accomplish in the end exactly what those who reject the operation accomplish, namely, he safety of the mother. We have at least tried to do more, o save the child as well.

It is not possible to estimate the proportion of children aved by the operation. It would be enough to justify it if we aved a child now and then that could not be saved by the orceps.

An important consideration in favour of turning is that ompression of the head in its transverse diameter is much less njurious to the child than compression in its long diameter. Radford, Ramsbotham, and Simpson insist upon this. Now when the forceps is used it is rarely possible to seize the head n its transverse diameter. The contracted flat pelvis throws he head with its long diameter into the transverse diameter

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of the pelvis, and the blades of the forceps, finding most room in the sides of the pelvis, will be apt to seize the head in its long diameter. One danger the child runs is from compression of the cord. Now it is a matter of observation that in cases of moderate contraction the funis is safer than in cases of normal pelvis. The cord commonly falls into the side of the pelvis towards which the face looks, and there it is protected in the recess formed by the side of the jutting promontory, so that if the soft parts are dilated so as not to compress the cord against the child's head, and if the labour can be completed under five minutes, or even a little more, the child has a very good chance.

We have stated above some of the arguments upon which the operation rests. The main mechanical argument lies in the following proposition: The head will come through the pelvis more easily if drawn through base first than by crown first. Baudelocque affirmed this. The bones overlap more readily if the squeezing force begins below. Osiander, Hohl, and Simpson insist upon this fact. It is disputed by McClintock and E. Martin. Martin especially maintains that, when the vertex presents, moulding may go on safely for hours; but that if the base come first the moulding must be effected within five minutes to save the child. We have stated some evidence upon this point. A woman with a slightly contracted pelvis, in labour with a normal child presenting by the head, is delivered, after tedious efforts, spontaneously and by help of forceps; the head has undergone an extreme amount of moulding, even of distortion. The same woman again is delivered of a child presenting by the breech; the labour has been easy, and the head has preserved more of its globular shape. All this we have seen several times.

Again, we have been called on several occasions to an obstructed labour, in which the head was resting on a contracted brim. We have tried the double-curved forceps under moderate compressive power aided by considerable traction, and have failed to deliver. We have then turned, and the head, coming base first, has been delivered easily.

The indications for the operation. Assuming a standard head, the base of which, unyielding, measures 3 inches, this is obviously the limit beyond which the operation would be

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useless; for although the head is caught in the bi-temporal diameter a little in front of the bi-parietal diameter, the base must be exposed in its full width to the narrowed strait. Even if the side of the head be indented by the promontory, no important degree of canting or obliquity can be counted upon. But if the head should be undersized or unusually plastic, there is a fair prospect of the child being drawn alive through a conjugate diameter measuring 3.00 inches. Generally, however, from 3.25 inches to 3.50 inches, or a little more, is the working range for a child at term. The great majority of those who advocate the operation insist upon this amount of space. It is important to have a fair saero-cotyloid diameter on one side, for if the ileo-pectineal margin of the brim incline rapidly backwards, the occiput will not find room.

Velpeau, Chailly, E. Martin, and others advise the operation in cases of unequally contracted pelvis where there is more room on one side than on the other, when the occipital end of the head is not already engaged in this larger side. To determine which side of the pelvis is the larger, attention to the following points will help: (1) If the woman walks straight, and the legs are of equal length, the defect in symmetry will be slight, but the presumption is that the right side is the larger; (2) if the woman has one hip affected, or one leg shorter than the other, the opposite side of the pelvis will be the larger; (3) the two half-circumferences of the pelvis externally from the crest of the sacral spine to the symphysis pubis may be measured and compared; (4) the hand in the pelvis may estimate the relative space in the two sides.

The cervix uteri should be dilated enough to admit the fingers pointed in a eonc, and dilatable enough to yield readily under the extraction of the trnnk. In this, as in most cases, where the head eannot press fairly upon the cervix, spontaneous dilatation is tedious. The hydrostatic bags render especial service. The membranes should be intact, or there should be enough liquor amnii present to admit of easy turning.

The contra-indications are: (1) A conjugate diameter narrowed to less than 3 inches; (2) firm contraction of the uterus round the child, balling it; (3) impaction or very firm setting of the head in the brim of the pelvis; (4) marked exhaustion or prostration of the mother; (5) death of he child.

The operation. As the conditions postulated admit of bi-polar action, it is important to avail ourselves of it. If exploration satisfy us that the pelvis is symmetrical, we turn according to the ordinary rules. Extraction should be gentle and slow until the breech is delivered. So long as the cord pulsates do not hurry; but if the pulsations flag, lose no time in liberating the arms. The pelvie contraction makes this a little more difficult than under ordinary circumstances. As

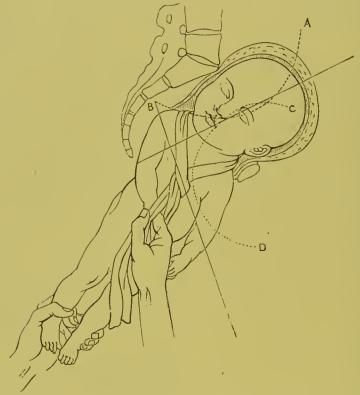


Fig. 115.—Showing a mode of extracting head delayed in contracted brim. (R. B.)

soon as the arms are liberated the real difficulty begins: the extraction of the head. Sometimes the head is delayed by being eneircled by the imperfectly dilated os uteri. This is an unfortunate complication, since compression at this point is likely to stop the circulation in the eord. It is above all things necessary to draw at first as much backwards as possible, so as to make the head revolve in Barnes's curve (A B, fig. 115) until it has cleared the strait, when it enters Carus's orbit, C D.

Traction is effected by holding the lcgs with one hand and the nape of the neck with the other. Commonly, the force thus obtained, aided by pressure from above upon the fundus, is enough, but sometimes more is wanted. This is obtained by crossing a fine napkin or silk handkerchief over the neck, bringing the two ends in front of the chest and drawing upon them, as in fig. 115.

When the pelvis is unequally contracted, the object is to throw the big or occipital end of the head into the more roomy side of the pelvis. E. Martin describes three modes of effecting this:—

- 1. A suitable position of the woman is secured. Let her lie on that side to which the forehead is directed. The fundus uteri will gradually sink with the pelvic end of the child to this side; the spine draws the occiput to the opposite side of the pelvis, and the forehead sinks more deeply towards the brim.
- 2. The forceps is a means of releasing the posterior transverse diameter of the head when imprisoned in the pelvic conjugate. This explains the frequent easy extraction when a little traction has been made. Martin admits that we must not be sanguine as to the success of this plan. We must be prepared to perforate if there be evidence of exhaustion.
- 3. Turning by the feet. How is this to be done? In consequence of the well-known law, that in complete foot-presentation the foot that is brought down always comes under the pubic arch, if the fœtus is not abnormally small or the pelvis too large, if we draw down the right foot, the child's back, and therefore its occiput, will come into the right half of the pelvis, and vice versâ. If, therefore, the right half of the pelvis is the larger, seize the right knee; if the left side is larger, seize the left knee.

Hohl and Strassmann doubt the possibility of securing this result. If it happens, it does so by accident. We believe the rule and practice are good and feasible, but the success of the operation is not necessarily imperilled even if the occiput should fall into the narrower half of the pelvis. We have saved children when this has happened, and Strassmann relates some striking cases in proof of this proposition.¹

If, after all, the forceps and turning fail, we fall back upon

¹ Monatsschr. f. Geburtsk., 1868.

craniotomy. There is no great difficulty in perforating the after-coming head. The child's body is drawn well over to one side by an assistant, so as to facilitate the access of the operator's guiding fingers and the perforator to the head. The best place to perforate is in the occiput, but if that part be not easily struck, the perforator may be run up through the base of the skull. An opening into the cranium being made, the crotchet is passed in, and the discharge of brain facilitated. Then resuming traction on the cord cautiously, the skull will probably collapse enough to pass easily. If not, the cranioclast, or the cephalotribe, must be had recourse to. If the forceps or turning have been tried at the proper time, before the patient is exhausted, retrieval by the secondary operation of craniotomy may be confidently expected.

General appreciation of the operation. For some years Robert Barnes, although possessing a far better forceps than Simpson's, accepted the teaching of this great master, and gave the preference to turning. This was advocated in the 'Obstetric Operations' (1876). Subsequent experience of his own, and the independent experience of Fancourt Barnes, especially with the axis-traction forceps of Aveling and Tarnier, have compelled him to revise the opinion expressed in that work. We have arrived at the conclusion that generally the forceps is to be preferred; and that in those cases in which the feet have come first, either spontaneously or after turning, still delivery of the after-coming head by the forceps is preferable to dragging the head through by the hands. The forceps should be tried first; and it is all important to use the axistraction forceps. Having brought forth living children by this instrument from women who had lost children by turning or with ordinary forceps, we cannot doubt its superiority. The axis-traction forceps, thus extending the domain of the forceps, pari passu lessens the domain of turning. This is a crucial test of the value of the axis-traction forceps.

The dangers to mother from turning. These may be summed up thus: (1) In cases free from disproportion, in which bi-polar turning can be effected without difficulty, the danger is small. (2) The danger rises when liquor amnii has escaped, and persistent action of the uterus has set in. Exhaustion, rupture of the uterus, sloughing of the vagina, injury

to the bladder, may be apprehended. (3) The danger rises still higher if, in addition, there be marked contraction of the pelvis, or the head be large and not plastic. In these cases force in passing the head may rupture the uterus or vagina.

Dangers to the child. The dangers to be apprehended are: (1) Asphyxia from compression of the cord; (2) from dragging in extraction before the cervix is dilated; (3) from dragging in a vicious direction, entailing dragging on the neck, the cervical articulations may give way; (4) from rotating the child on its long axis the neck may be twisted; (5) from compression and laceration of the brain or its vessels during extraction; (6) from direct pressure upon the placenta between the child's head and the uterus asphyxia may result. The same result may happen from unintermittent uterine contraction arresting the utero-placental circulation.

We do not attempt numerical estimates of mortality, for reasons similar to those stated in reference to statistics of mortality from forceps. The sources of fallacy are too great to justify the attempt.

CHAPTER XIV.

EMBRYOTOMY: INDICATIONS FOR; PELVIC DISTORTION; DISPROPORTION BETWEEN HEAD AND PELVIS; THE OPERATIONS; CRANIOTOMY; CEPHALOTRIPSY; LAMINATION OF HEAD. DANGERS ATTENDING EMBRYOTOMY.

Reluctantly passing from the conservative operations of the forceps and version, we turn perforce to the sacrificial operations of embryotomy, in obedience to the peremptory law which enjoins us to sacrifice, if need be, the child in order to save the mother. Coming after the forceps and turning, craniotomy stands before the Cæsarian section—an operation which, although conservative in design, is so dangerous to the mother that it is held better to avoid it by sacrificing the child.

The motive of the operation is to save the mother by reducing the child's bulk to such dimensions and other conditions that it may be delivered with the least possible injury to the mother. One form of embryotomy has been described in the chapter on 'Version,' namely, spondylotomy and decapitation. The form which specially demands attention now consists essentially in reducing the bulk of the cranium, this part presenting. Hence the term craniotomy.

Analysis of the operation. Craniotomy consists of several successive operations or acts, as: 1. Perforation of the skull.

2. Excerebration. 3. Extraction, simple: (a) by crotchet; (b) by cranioclast, or extraction after crushing down the cranium by removing portions of the cranial vault by the cranioclast, by the cephalotribe; (c) by lamination; (d) by breaking up the base of the cranium by the basilyst.

The indications for the operation. These may be classed in three orders:—

A. Dystocia from such contraction of the pelvis as will not give passage to a live child, or even a dead child, when the forceps and turning are excluded or have failed.

- B. Cases where obstruction is due to the child.
- C. Cases where the woman is in danger, rendering it expedient to deliver as speedily as possible, and where craniotomy offers the quickest relief and involves the least violence to the woman. Some cases of hæmorrhage, of convulsions, great exhaustion, rupture of the uterus, and generally where, prompt delivery being indicated, the cervix uteri is not sufficiently dilated or dilatable, or extreme spastic rigidity not admitting of conservative operations. In cases of atresia, cicatricial, or from malignant diseases of the cervix or vagina; also in cases of dystocia, the child being dead. Under this order may also be classed obstruction from tumours (see p. 535). B and C have been pointed out in the opening section on 'Dystocia' (see p. 577).

A. Dystocia from pelvic distortion. Craniotomy finds its application where labour at term is obstructed from pelvic contraction, the conjugate diameter ranging from 3·25 or 3·50 inches as a maximum, to 1·75 or 1·50 as a minimum. If labour occur at seven months, the operation may be available in contraction to 1·50 inches or a little less. F. Ramsbotham held that a full-grown child might be extracted through a pelvis measuring 3 inches in the lateral, and 2 inches, or even 1·75 inches, in the conjugate diameter. And since his time the instruments and methods of reducing the child, and of extracting it, have been materially improved.

Still it is very difficult to set exact limits to the operation on the sole basis of pelvic distortion. We may determine this factor with some approach to precision; the other factor, the properties of the fœtus, and, we may add, the skill of the operator, cannot be determined. Nor can the history of a given patient's previous labours, valuable as this often is, be always trusted. It would not be right to assume that because a woman has been delivered on previous occasions by the natural powers, by forceps, or by turning, it is therefore unnecessary to resort to craniotomy. It is, indeed, a strong reason to pause and examine carefully. It is a matter of experience that some women bear children with increasing difficulty. This may be from two causes: (1) Advancing pelvic distortion; (2) increasing size of the child. We can affirm the reality of the first cause from repeated observations. We have histories

of women whose first labours have been natural, and whose succeeding labours exhibited difficulties increasing in accelerated ratio, rising from the forceps to turning and craniotomy. The second cause may be independent of or aggravate the first. The observation of D'Outrepont, that in women whose first children were small, subsequent ones became bigger and bigger, has been verified by recent researches.

B. Hydrocephalus is a rare but decided indication. The condition may be recognised by the slow, ineffective labour; the expansion of the head-globe, only a segment of it entering the pelvic brim; the bulging of the scalp like a bag of membranes under the uterine contractions; the widely-separated bones by broad membranes; the loose bones. After perforation the scalp feels 'like a bag of bones.'

C. Cases where indications arise from the state of the mother need no particular description here.

The operation. An important question is, at what stage of the labour shall we begin? As most of the dangers flow from exhaustion, it is obviously proper to begin as soon as the indication for the operation is clear and the conditions admit of its being fairly carried out. On the Continent, especially, it is still urged by some that we should wait until the child is dead. If it be admitted, and the conditions of the case involve these postulates: (1) that the child cannot come through alive, (2) that the operation is undertaken in order to save the mother, waiting till the child is dead is opposed alike to reason and to humanity. It seems a refinement of casuistry to distinguish between directly destroying a child, and leaving it exposed to circumstances which must inevitably destroy it; and it is risking the very object of our art to wait for the lingering death of the child until the mother's life is also imperilled.

There is no need to wait for the far advance of labour. It is rarely desirable to wait long after the rupture of the membranes. It would, in many cases, be useless to wait until the full dilatation of the cervix uteri. It is one of the necessary results of contracted brim that the cervix uteri dilates slowly and imperfectly. The head-globe, resting by two points of contact on the contracted brim, cannot bear upon the cervix. It is therefore often right to perforate when the cervix is open enough to admit two or three fingers. When the head col-

lapses and comes down into the pelvis it bears upon the cervix, which then gradually yields.

Although it is a good general rule to perform every operation as early as the indication for it is clearly recognised, it is not expedient, in minor degrees of contraction, to arrive too quickly at the conclusion that perforation is necessary. Time and opportunity should be given to Nature. The head may be small and plastic, and occasionally even a full-sized head will, under continued action of the uterus, become so moulded as to admit of delivery either spontaneously or by aid of the forceps.

The operation: Preliminary proceedings. Empty the bladder and rectum; place the patient in the left lateral or in dorsal posture. Anæsthesia is rarely desirable before the stages of fixing the cephalotribe and extraction begin.

First act: Perforation. This is the first step in all operations for lessening the bulk of the head. The necessary condition for full collapse of the cranial bones is that the support given by the brain and the integrity of the cranial vault should be broken down. The skull, unbroken and full, is all but incompressible. By great expenditure of force and time some amount of moulding, but no diminution of bulk, ean be obtained. Powerful forceps and even cephalotribes may be bent in the attempt to erush in the head; whereas, break the arch of the cranial vault, allow the contents to escape, and very moderate compression by instruments, and even the natural forces, will eause collapse, more or less complete. Besides, more room is required if we apply the cephalotribe to the unbroken head. This argument is rendered necessary by the fact that some obstetrists still practise cephalotripsy without perforation.

A final exploration should precede perforation. The left hand of the operator should be passed into the pelvis, under anæsthesia if necessary, so as to explore thoroughly the shape and dimensions of the pelvis and the relations of the head and cervix uteri. Three points should be clearly made out: (1) The projection of the promontory, which in extreme cases has been mistaken for the head; (2) the outline and position of the head; (3) the os uteri should be well defined. The finger passed inside the cervix should be made to sweep all round the circumference of the head. Thus we shall define precisely the point to strike with the perforator.

The point selected is that which presents most centrally. An assistant should support and fix the head upon the pelvic brim, so as to obviate the retreat or rolling of the head under the impact of the perforator. It is also necessary to take care that the instrument strike the skull perpendicularly. Sometimes, in cases of great deformity, the uterus is so twisted from its normal direction that reposition is necessary before the os can be brought near the centre of the brim to allow of safe perforation.

Taking Oldham's perforator in the right hand, two fingers of the left hand are passed up to the head, keeping the os uteri at their back; the instrument is then run up in the groove formed by the fingers. The point having struck the spot selected, the perforation is effected by a movement combining boring and pushing. When the skull is pierced, push the blades in up to the shoulders; then open the blades to enlarge the aperture, turn the handles at right angles to the first position, and open the blades again, so as to make a free crucial opening. This breaks the continuity of the cranial arch; it allows free discharge of the cranial contents, and ample entry for the crotchet or blade of the cranioclast.

Now you may wait awhile, to afford opportunity for spontaneous compression and collapse, or you may at once pass in the crotehet. This should be passed in as deeply as possible and moved freely round in all directions, to break up the tentoria and brain. This proceeding greatly facilitates the evacuation and collapse of the skull. This is excerebration.

If the disproportion is not great, and the patient's powers are good, it commonly happens that uterine action sets in as soon as the bulk of the head is a little diminished. The resulting compression and propulsion may suffice to expel the child. It seems as if Nature resumes work as soon as she realises the fact that it can be done efficiently. Reasonable opportunity should be given for the spontaneous process.

Should no advance be made, the ease falls into the second order, and we must proceed to artificial compression of the

skull, and next to extraction.

Second act. Extraction may be accomplished in several ways: (1) By the crotchet. The proper use to which the crotehet should be applied is that just described in execrebra-

tion. It was long used in this country for extraction; but it has, we trust, been generally abandoned for the cranioclast and the cephalotribe. The objections to the crotchet are serious: It gives a very weak hold of the skull; it is apt to tear off a bit of bone or scalp, and the hold is lost; it is apt in slipping to tear the mother's soft parts; and, lastly, it is only capable of extracting the head in those minor cases of disproportion, in some of which it might be doubted whether craniotomy was necessary. But since a good cranioclast or cephalotribe may not be at hand, the mode of using the crotchet must be described. The fingers of the left hand guide the end of the crotchet into the hole in the skull. Two fingers are then passed up outside the skull to serve as a guard and support to the sharp point of the crotchet, which is fixed into the bone inside. The part first seized by the crotchet is not, perhaps, very important, since if there be any great resistance the part will be broken away, and a fresh hold must be made. This may have to be repeated several times, pieces of the parietal, occipital, or frontal bones being successively torn out. Whenever a piece of bone is detached, it is wise to remove it altogether. This may generally be done with the fingers. By-andby—for the process is apt to be tedious—when the cranial vault is much broken up, if a good hold can be got in the occipital bone or in the foramen magnum, collapse of the skull takes place, and extraction is successful. In very difficult cases, when the vault is well broken up, it is better to take hold in the orbital region, fixing the point of the crotchet either inside the skull under the sphenoid on one side of the sella turcica or n the eyeball. In this way the base is brought into the brim edgewise.

- 2. Extraction by turning. When the cranial vault is broken he bones will readily collapse if the skull be drawn through he contracted brim base first. The torn scalp during extraction s drawn over the jagged edges of the bones. The child, being lead, does not always lend itself readily to turning. It may be necessary to pass the hand into the uterus, which is moulded on the child, and through a brim so contracted as to oppose considerable difficulty. Turning, however, must be regarded as a valuable resource in emergency.
 - 3. Extraction by cranioclast. This is generally preferable to

turning. The use of this instrument is twofold: it will seize and extract the head; it will seize and remove portions of the cranial vault. The first use is adapted to minor degrees of disproportion; the two uses combined may effect delivery in extreme disproportion. What part of the vault is best to seize? If the head is found to collapse, and the disproportion is not great, it is enough to seize the forchead, which, being generally directed to the right ilium, is the easiest to seize. But if there

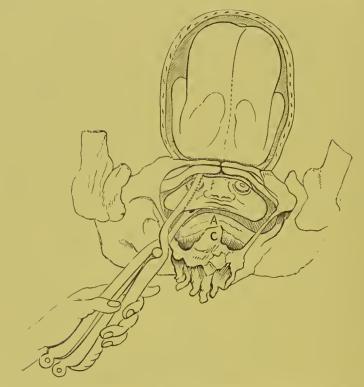


Fig. 116.—Entraction by Barnes's Cranioclast, after picking off vault of cranium. (R. B.)

A. Projecting promontory of sacrum. C. Tip of coccyx.

is any great difficulty, it is generally better to quit the forehead and seize by the occiput. The head will not come down well, face presenting, unless the vault and occiput are in a condition to be crushed in against the base. In this proceeding, compression of the skull is effected by its being drawn through the narrow passage formed by the soft parts supported by the pelvis. The head must, therefore, be ductile enough to admit of the necessary compression and clongation. If the skull be too

unyielding or the passages too small for this process, a totally different principle must guide us. Portions of the vault must be removed, and then we get the most remarkable advantage.

Osborn contended that by canting the base of the skull, so as to bring it edgewise into the brim, it was quite possible to deliver a full-sized child through a conjugate diameter measuring an inch and a half only (fig. 116). Burns came to the same conclusion, and showed that by reducing the skull to its base, and bringing it through as in face-presentation, nothing was opposed to the conjugate but the distance from chin to orbital plates, which is rarely much more than an inch. This subject has been investigated by Braxton Hicks. Having removed the calvarium, he grapples the orbit with a small blunt hook; the hook is hard, the stem soft, so as to admit of easier adaptation. The face is then drawn gently down, turning the chin forwards, as occurs in face-labours. A fresh hold in the mouth or under the jaw is then taken for traction.

4. The authors' method. We prefer the cranioclast. The proceeding we practise is as follows: Pass the inner or small blade into the cavity of the skull; then the outer blade is adjusted between the portion of bone to be removed and the scalp. Then a considerable piece of parietal or occipital bone being seized, by a sudden wrench is broken, and then cautiously twisted off and brought away under the guidance of the left hand or fingers in the vagina. If the distortion is not extreme, it may be enough to break away two or three pieces, say an angle of each parietal and of the occipital. This destroys the arch of the calvarium; the remains of the walls then easily fall in upon the base, forming a flat eake or disc, when the head comes . to be compressed in the chink of the brim. When enough bone has been taken away to admit of this flattening in, the blades of the cranioclast are made to seize the forehead and face, the screw working at the ends of the handles helping to crush in the frontal bones, and to secure an unyielding hold. The cranioclast, in fact, here acts like the cephatotribe, possessing the advantage of taking up less room. Then traction is made first in Barnes's curve. As the face descends it tends to turn chin forwards. and this may be promoted by turning the handles of the instrument. It is not necessary that this turn should take place.

for the ease differs entirely from that of the normal head. There is no occiput to roll back between the shoulders. The head comes through flat like a disc.

If the pelvic contraction be very decided—say to 2.50 or 2.00 inches or under—it will be wise to take away the greater part of the frontal, parietal, squamous, and occipital bones before extraction. By this proceeding delivery can be effected in all but the very extreme degrees of contraction. We are convinced that it competes successfully with cephalotripsy for the credit of averting Cæsarian section.



Fig. 117.—Extraction by Barnes's Cranicclast, after removing bones of cranial vault. Seen in section. (R. B.)

5. Delivery by cephalotripsy. The eephalotribe takes more room than the cranioclast, and, therefore, in some cases the cranioclast or the basilyst is to be preferred. Nevertheless, cephalotripsy possesses considerable special advantages, and may lend much help to other proceedings.

The powers of the cephalotribe. The essential point is that it shall be able to compress and crush down the remains of the

alvarium upon the base of the skull, so as to bring the flatened skull to the condition of a disc that shall pass through he pelvic chink. A secondary property is that of holding uring extraction. The cephalotribe, then, is a reducing and n extracting instrument. Most of the French and German nodels are unnecessarily bulky. The requisite force can be btained with less size and weight of metal. Having worked ith Simpson's, Kidd's, and Braxton Hicks's instruments, we ave recognised the importance of a slight pelvic curve which ficks's possesses; but we find the blades too short to seize the



Fig. 118.—Fancourt Barnes's Axis-traction Cephalotribe, applied.

ad above the brim. All the difficulties seem overcome in Fanurt Barnes's cephalotribe (see 'Armamentarium,' fig. 63). It has slight pelvic curve, sufficiently long and powerful blades, and e special advantage of the perinæal or Aveling's curve. The adntage this gives in traction can hardly be appreciated except those who have had comparative experience. The facility incd by axis-traction is very marked, and by so much is the k of bruising the mother's structures lessened.

The action of the cephalotribe, applied to the perforated ad, is partly to crush the base, imparting greater plasticity;

then the base is tilted edgewise, and the skull is flattened down by squeezing the squamous and parietal bones on to the base (see fig. 118).

It is sometimes held, and still taught, that the cephalotribe acts by crushing up the base of the skull—that is, by breaking into pieces the solid disc formed by the sphenoid, temporals, and basilar process of the occipital bone. This is an error. The moment the disc is seized by the blades of the cephalotribe, it tends to cant over and lie flat between the blades, the loose bones of the calvarium being crushed down upon it. Seizure and compression of the base so accurately as to secure crushing it up is almost a mechanical impossibility. The slightest inequality of seizure on the two edges, the slightest inequality of force, will necessarily entail canting. It is to obviate this and ensure crushing the base that the basilysts are contrived. For this purpose Goyon and A. R. Simpson begin by perforating the base.

Ingenious and effective as these proceedings undoubtedly are, we cannot regard them as superior in safety or effectiveness to the process of cephalotripsy as we have described it. By this process, the head can commonly be so flattened as to allow the blades almost to meet; and as the instrument then measures only 1.50 inches, the obstacle is reduced to that degree. It is generally desirable to repeat the crushing, which is done by taking a fresh hold in a different direction, and then compressing again. This increases ductility.

The operation. The patient may lie on the left side or on the back. The head is perforated as already directed. The rules laid down for the long forceps will generally apply to the adjustment of the blades of the cephalotribe. The lower or posterior is passed first, guided by the left hand, passed well into the pelvis if possible. This blade is passed along the hollow of the sacrum until the point approaches the brim and touches the head-globe; then the handle is raised, and the point, turning into the left ilium or to the left sacro-iliac joint, travels over the head. It is passed high up, for the point of the instrument must get beyond the base of the skull. This blade being in situ, the second or anterior blade is introduced also at first in the sacral hollow, crossing in front of the first blade. When the point approaches the brim, the

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haudle is lowered and carried backwards, and the point rises over the head-globe into the right ilium, or opposite the right cotyloid cavity, when it falls into apposition with the first blade. Being locked, the screw is turned slowly and steadily, the hand in the vagina taking note of the work done. If spicula of bone crop up out of the scalp, they should be picked away by the fingers or the cranioclast. When the head is crushed in the direction first seized, the instrument may be used as a tractor. If there be any marked resistance, it is better to take off the blades, to reapply them in the opposite direction, and repeat the crushing. This much increases ductility. Then rotate the head by turning the handles about a quarter of a circle, to bring the flattened head into rotation with the transverse diameter of the brim before extracting, so as to bring the head, flattened like a disc, to enter the chink of the inlet of the pelvis. It is not, indeed, always necessary to give this rotation. The necessary adaptation may take place spontaneously. Extraction in the direction of the pelvic axis is thus nade, taking care to allow time for moulding and for the dilaation of the cervix uteri, vagiua, and vulva.

When the head is extracted, there may be some trouble with the shoulders and trunk. The shoulders will generally be lisposed obliquely in the brim—that is, one will be anterior to the other. By keeping up axis-traction on the head backwards, he anterior shoulder will be brought a little down, so that finger or a blunt hook or crotchet can be fixed in the axilla to oull it through. When this is done, the head is dragged down orwards, so as to enable the same manœuvre to be repeated vith the posterior arm. If this cannot be readily done, it is a good plan to crush in the chest with the cephalotribe. In extreme cases it is sometimes useful to use both cephalotribe and cranioclast. For example, the cephalotribe having crushed and seized the presenting part, and served to draw it down to a ertain extent, the instrument may slip a little, or the fœtus nay show signs of giving way above the point gripped. The raniotomy-forceps may then be made to take a fresh hold at a ligher point.

If turning has been practised after craniotomy or cephaloripsy, the arms fall in upon the crushed head, and offer no erious obstruction.

To avoid the ghastly sight of the mangled head, a napkin should be wrapped round it as soon as it is born.

In this country, when good instruments for embryulcia were unknown, it was the practice to leave the head after perforation to be gradually moulded and expelled. Pajot advocates an analogous proceeding, which he describes as 'céphalotripsie répétée sans tractions.' He first crushes in the base by one operation, and he then gently tries to effect a slight rotation of the instrument, so as to bring the crushed sides of the head into relation with the contracted inlet. If there is any resistance he desists, and leaves the case for two or three hours for the uterus to mould the crushed head to the brim. He then repeats the crushing, and again gives two or three hours to Nature. One or two crushings suffice for the trunk. Chiara gives a good case in illustration. Pajot places this method in distinct competition with Cæsarian section. His cases lend weight to his recommendation. But we cannot help thinking that the operation may and generally ought to be completed at one sitting. The head expands again to a considerable degree when the cephalotribe is taken off. And waiting upon Nature may be to invoke exhaustion.

Delivery by lamination. To overcome the obstacles opposed by the unyielding base of the skull and the bulk of the cephalotribe, various other modes of reducing the skull have been devised. The general aim of these is to cut the skull in slices or pieces. Hence the term 'lamination.' One of the first of these contrivances is Van Huevel's forceps-saw. It was introduced in 1842. It is a distinctive feature of the Belgian school. Hyernaux rejects in its favour all crotchets and cephalotribes. The instrument has also found favour with Faye, of Christiania, and Billi, in Italy. It consists of a long powerful forceps with the pelvic curve, the blades of which are grooved along the inner aspect in order to carry a chain-saw. When the head or other part of the child is seized by the forceps, this chain-saw is worked up from the point whence the blades spring by means of cross-handles attached to the two ends; thus travelling up the grooves, the saw crosses the head and cuts through it. For extraction Van Huevel contrived a pair of forceps toothed on one blade.

Preface to French edition of Robert Farnes's Obstetric Operations.

The objection to this instrument is its bulk. This renders it difficult or impossible to apply when the conjugate is reduced to 2.00 inches, or even to 2.50 inches. The blades must be got to lock accurately in order to work the saw. Obstruction to these degrees can be more easily overcome by perforation and the cephalotribe or cranioclast.

Delivery by Robert Barnes's method by the wire-écraseur (1869). The difficulty of finding room for the cephalotribe in extreme distortion led the senior author to adapt the wireéeraseur to lamination. Nothing ean take up less space than a wire. It is desirable, but not necessary, first to perforate. It further facilitates the operation to twist off a portion of the parietal bones by the cranioclast. The wire-loop thus buries itself more readily in the skull, a smaller loop is required, and it euts its way through the base more readily. If the sphericity of the globe is not first destroyed, the wire-loop is apt to glide off the head, seizing only the scalp when the screw is worked. The crotchet is next passed into the hole made by the perforator, and held by an assistant so as to steady the head (see fig. 119). A loop of strong steel wire is then formed, large enough to encirele the head. The elasticity of the wire permits of the loop being compressed by the fingers, so as to make it narrow enough to slip through the cervix and the chink of the pelvic brim. The loop is thus guided over the crotchet to the right side of the uterus, where the face lies. The compression being removed, the loop springs open to form its original ring; this is guided over the anterior part of the head as in fig. 119 B. The screw is then tightened; instantly the wire is buried in the scalp. Here is manifested a special advantage of the operation, the whole force of the necessary manœuvres is expended upon the fœtus. There is no outward pressure upon the mother's parts, which to some extent is inevitable with the cephalotribe or Van Huevel's forceps-saw. When the anterior or posterior segment of the head is seized in the wire-loop, a steady working of the serew cuts through the head in a few minutes. The loose segment is then removed by the cranioelast.

In minor degrees of contraction, the removal of one segment is enough to enable the rest of the head to be extracted by the cranioclast. But in cases of extreme distortion it is desirable still further to reduce the head by taking off another section This is best done by reapplying the loop over the occipital and end of the head, as seen in fig. 119 A. It thus accomplishes what the cephalotribe does not; it breaks up the base of the skull.

The small part of the skull still remaining attached to the trunk offers no obstacle. It serves as a hold for traction. The cranioclast seizes it firmly, and the delivery of the trunk is

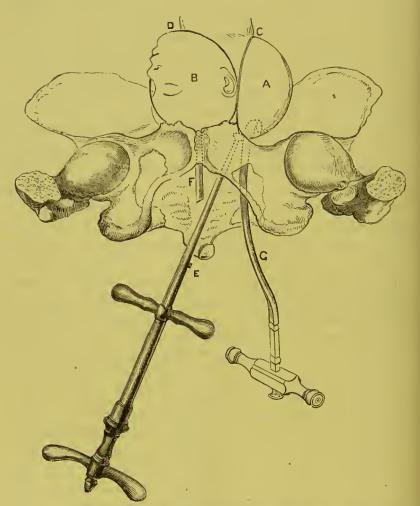


Fig. 119.—Showing Robert Barnes's operation of Lamination by the Ecrascur.

proceeded with. If the child be well developed, this task will require considerable skill and patience. An assistant draws steadily on the cranioclast, directing traction to one side so as to bring a shoulder into the brim. The operator then hooks the crotchet into the axilla, draws it down, and with strong

seissors amputates the arm at the shoulder. This proceeding is then repeated on the other arm. Room is then gained to deal with the thorax. This is then perforated. One blade of a strong scissors is passed into the aperture; the ribs are then cut through in two directions. Then the thorax and abdomen are eviscerated by the crotchet, until the trunk is in a condition to collapse completely. This done, moderate traction will complete delivery.

We have designed a proceeding by which the arms can be amputated even more easily. A curved tube, shaped like Ramsbotham's hook, may be made to carry a strong wire under the axilla; and the end being brought out and the tube removed, the wire can be attached to the écraseur. This cuts through the limb with ease and security. Decapitation may be conveniently performed in the same way. Wasseige's crotchet is made on this principle to carry a cord. Pajot decapitates by a whipcord. Tarnier's method is carried out by an apparatus similar in principle to Van Huevel's, but much lighter and taking up less room. It consists of two branches or stems, one of which is curved to correspond with the sacral curve, the other is nearly straight. These branches carry a travelling chain-saw, which, like Van Huevel's, works from below upwards, so that the division of the skull begins below. Having cut through to the base, one can begin again, and so take out a wedge-shaped slice or section.

Numerous other instruments have been designed. We may note those of Jacquemier, Wasseige, Van der Ecken, Stanesco, Pierre Thomas. They are figured and described in

Charpentier.1

The dangers and mortality attending embryotomy. Certain injuries may be inflicted upon the mother: 1. The perforator has been known to laccrate the soft parts, and even to strike the promontory of the sacrum. 2. Spicula of eranial bones may scratch or tear the soft parts. 3. The crotchet may slip and lacerate the soft parts. These accidents may be avoided. 4. The cephalotribe may bruise the soft parts. The risk of this may be greatly lessened by using the axis-traction instrument 5. But serious evil is likely to result from deferring the operation too long—that is, until exhaustion has set in, and

¹ Traité Pratique des Accouchements, tome ii., 1883.

under a too-protracted operation in an unsuitable case. Longcontinued dragging of the head upon a brim which it cannot pass, jamming the soft parts, especially at the two points of greatest projection, the promontory and the symphysis pubis. ends by stopping the circulation in the parts compressed, bruising them, actually grinding through them. Such injury, added to the shock and exhaustion, may be fatal. The soft parts at the vulva and perinæum, greatly deprived of vitality, lose elasticity. They become livid or black from congestion, and break down or tear like wet brown paper. When the tissues have arrived at this point recovery is doubtful, and, if attained, sloughing, more or less extensive, ensues. It is a form of acute necrosis. 6. Long-continued pressure may cause mortification of a limited portion of the neck of the uterus. In the course of a few days a slough may be formed between the vagina and bladder, leading to vesico-vaginal fistula.

It is impossible to determine the maternal mortality resulting from embryotomy. The causes of death are complex. The injuries attending the labour itself, the shock and exhaustion due to protracted unavailing labour, and the injuries done during the operations, are often inextricably mingled. The danger of injury of course rises with the degree of distortion, the imperfection of the instruments, and the lack of skill of the operator. Thus we at last arrive at a point where the danger of embryotomy becomes so great as to raise the question whether the Cæsarian section is not safer, and therefore to be selected.

CHAPTER XV.

THE CÆSARIAN SECTION: GENERAL DISCUSSION; MORTALITY. INDICATIONS FOR: EXTREME PELVIC CONTRACTION, TUMOURS, MALIGNANT DISEASE, WHEN MOTHER IS MORIBUND. THE OPERATIONS: SIMPLE, PORRO'S, LAPARO-ELYTROTOMY, CÆSARIAN SECTION PLUS REMOVAL OF OVARIES. CAUSES OF DEATH. APPRECIATION OF THE SEVERAL OPERATIONS. SYMPHYSIOTOMY, OR THE SIGAULTIAN OPERATION.

THE Cæsarian section is an operation by which the child is extracted through an incision made in the abdominal wall and the uterus.

The Cæsarian section occupies a doubtful place between eonservative and sacrificial obstetrics. It is conservative at least in design. It is not necessarily fatal either to mother or ehild. If the operation could be done at a chosen moment, and so improved as greatly to increase the probability of saving the mother, then the already high probability of rescuing the ehild might turn the scale in favour of the Cæsarian section, and against embryotomy. Unfortunately, art has not yet reached this point. The mortality to mothers from Cæsarian section is still so great, whilst that from embryotomy in fitting eases is so small, that we are unable at present to raise the Cæsarian section to the rank of an elective operation. It is impossible to attain accurate data for estimating the risk to life caused by the Cæsarian section. It is certainly so great that no one undertaking it can reckon with any confidence upon a successful result. Pajot says 1: 'This operation has cost the lives of all the unhappy women who have undergone it in Paris, since the beginning of this century. And it is still practised!' For a hundred years there had not been a recovery

¹ Preface to Robert Barnes's Diseases of Women (1875), French edition

after a Cæsarian section in Vienna. In Italy the old operation was almost always fatal. Chiara said that out of sixty-two cases operated on by Porro, Lazzati, Billi, and himself, only three recovered. Probably these figures give too gloomy a view. We have spent much labour upon general medical and obstetrical statistics, and have arrived at the conclusion that nothing is more untrustworthy or more misleading. We have, therefore, abstained from encumbering this work with statistical tables. Those who take an interest in this mode of obscuring a clinical question will find material in Churchill and Charpentier. We will simply here reproduce from Schroeder a summary, drawn up in 1874, of Mayer's results of the operation in England, Germany, France, Belgium, Italy, and America. 1,605 operations gave 54 per cent. recoveries. The proportion of recoveries is certainly not understated. And yet it is but fair to point out that it is not less certain that many deaths, occurring after Cæsarian section, were due to eauses acting before the operation was performed, and only secondarily to the operation itself. Like things only should be compared. Rightly to estimate the mortality from Cæsarian section, we must weigh those cases only in which the operation was done at a selected time, and which were uncomplicated with other dangerous conditions.

To what extent is terrible risk encountered by the mother balanced by the saving of infant life? This question does not admit of a precise answer. Keyser says the infant mortality is 30 per cent.; and this figure does not include the infants dying within a few days. Scanzoni ascertained the fate of 81 children out of 120 operations performed between 1841 and 1853; 53 children, or 60 per cent., were born alive. The mortality is certainly greater than in ordinary labour. Nor are we entitled to weigh infant life against maternal life. If the question be decided by the estimate formed of the relative value of the mother's and the infant's life, the answer must be in favour of the mother. If delivered by embryotomy her recovery is highly probable, and she may bear a living premature child hereafter. But the final argument is that it is the mother's inalienable right to be saved, even if that involve the sacrifice of her child. The operation is essentially one that is performed in the interest of the mother. It is an operation imposed by necessity, as the only means of effecting

delivery. To accept it as one of election, it must be shown to be the best means of effecting delivery.

We have seen that embryotomy is practicable with a reasonable prospect of saving the mother when the conjugate diameter is reduced to 1.75 or 2.00 inches. The Belgian school, as represented by Hyernaux, admits the Cæsarian section at 4 centim. = 1.50 inches. The opinions of older authors, who asked for 2.50 or 3.00 inches in the conjugate, must be taken with the qualifying allowance that they worked with defective embryotomy instruments. The improvements in these instruments, the limit of which we believe is not yet reached, has reduced within narrower compass the necessity for resorting to the Cæsarian section. Some men still contend that embryotomy cannot safely be performed with a contraction below 2.50 inches. We submit that this argument is entirely subjective; it applies simply to those who urge it. They cannot reasonably impose their own limit upon others possessed of greater skill.

The conditions that render the Casarian section necessary. The most frequent condition is deformity with contraction of the pelvis. The operation is justified when the contraction is such that we cannot hope to deliver the child per vias naturales, whole or mutilated, without greater danger to the mother. The degree of contraction at which this occurs may be stated generally at 1.50 inches and below; at the higher limit of 1.50 inches the Cæsarian section comes into competition with embryotomy. But we may reasonably hope to carry the minimum to 1.00 inch. Cases may indeed occur in which a conjugate diameter of 2.00 inches may call for Cæsarian section if the pelvis be much distorted, so that the diagonal and transverse diameters offer insufficient compensation for the narrow conjugate. This is more especially the case when, as in osteomalacia, the cavity and outlet of the pelvis are also so contracted and rigid as to render the introduction and manipulation of instruments impossible. Extreme cases of rickets and spondylolisthesis sometimes render the operation necessary.

Abdominal and pelvic tumours may render the operation necessary. The most common are uterine fibroids, dermoid cysts, and ovarian cysts. When these block the pelvis, impeding the entry of the child, and cannot be dealt with by

pushing them up out of the way or by tapping, the Cæsarian section may be the only alternative. And care should be taken to select this operation when there is reason to apprehend bursting or other serious injury of the tumour if the child were dragged past it through the normal passages. Fibroid tumours of the lower segment or neck of the uterus constitute a strong indication.

Dr. Sadler reported a case in which the operation became necessary from the pelvis being filled up with an enormous hydatid cyst springing from the liver. Cystic disease of the kidney might cause similar difficulty.

In certain cases of extra-uterine gestation complicating uterine gestation, the abdominal section may offer the best solution.

Malignant disease of the lower segment of the uterus may also call for the operation. Labour at term, involving, perhaps, laceration to an unknown extent, and certainly scrious crushing of the morbid tissue, presents in most cases greater danger than Cæsarian section.

If cancer invade the cervix, the surrounding tissues being still free—and the case may come under observation before the child is viable—there are three alternatives: (1) We may consider it most judicious to let things go on to term; or (2) the diseased cervix may be amputated by the wire-écraseur, by galvanic cautery wire or the knife; or (3) the entire uterus may be amputated through an abdominal section. Spencer Wells published a successful case.¹ If the condition is first observed when the child is viable, the Cæsarian section after the manner of Porro is indicated.

Similar arguments apply to some cases of fibro-myoma of the uterus.

Rupture of the uterus, we have seen, is best met by the abdominal section. The like rule holds when there is atresia of the cervix uteri and vagina, which cannot without great danger be encountered by embryotomy.

It is also indicated in some cases when the mother is in extremis, or even dead, in the hope of rescuing a living child. Intimately associated with this question is the length of time a child in utero may survive its mother. No precise answer

can be given to this. The fætus in the lower animals will live some time if the ovum is not opened. It seems not improbable that a modified degree of placental circulation may continue for some little time after the mother's circulation has been stopped; and it is certain that the fætus may survive for some little time in a state of asphyxia or suspended animation, capable of restoration on being brought into the air. Children have been extracted alive ten minutes after the mother's death. Wrisberg cites three cases of infants born enclosed in the membranes; they lived—one seven minutes, and the two others nine minutes while thus enveloped. Brunton relates a case 1 of a seven months child expelled in intact membranes, from which it was taken out alive after an estimated interval of fifteen minutes.

The chance of rescuing the child by Cæsarian section post mortem will be much influenced by the circumstances attending the mother's death. If she dies from phthisis or other exhaustive disease, it may survive some minutes. If she dies from hæmorrhage or rupture of the uterus, the child's death is likely to precede that of the mother.

The Cæsarian section after death comes into competition with forced delivery per vias naturales. Sometimes, if the cervix is dilated, the child may be extracted by turning as quickly as by Cæsarian section. Turning has the advantages of being less likely to shock the friends, and it may be practised when the section would be rejected. The view that forced labour may be practised on the moribund has found favour in the Italian school. Belluzzi thus saved two children. Amongst Roman Catholics it is held to be imperative to deliver the child in order that it may be baptized.

The operations. There are four varieties of the Cæsarian section: A. The Cæsarian section simple. B. Perro's operation. C. Laparo-clytrotomy. D. Cæsarian section, plus the removal of the ovaries.

A. The Casarian section simple. Questions preliminary to the operation: What is the best time to select? It is assumed that the operation is unavoidable. Sometimes all choice is denied us, or the range of time is very limited. The indications once recognised, it ought not to be delayed. It is a

¹ Obst. Trans., vol. xiii.

misfortune, tending fatally to compromise success, to be obliged to operate when the system is prostrated; when the structures that have to be wounded are so worn and injured that the power of reaction and repair is seriously reduced; and when the blood is deteriorated by the products of nervous and muscular overwork.

If the patient come under observation early in pregnancy, we have the double opportunity of inducing labour, avoiding the operation, and of selecting the time for its performance should it be unavoidable. Is it an advantage to operate during labour, waiting upon Nature to give the signal? It has been held that the epoch which Nature has fixed for labour presents the most favourable conditions for the process. The whole organism is better prepared. The uterine muscles having acquired full development, and contraction having actually set in, it seems reasonable to anticipate that the wound made in the uterus will close better, and the processes attending delivery will be more safely carried ont. Ludwig Winckel, who has had great experience in the operation, says the most favourable time is the end of the second stage, when the membranes are ready to burst. He advises not to rupture the membranes. The escape of liquor amnii into the abdomen does no harm, and the extraction of the child is more easy if the membranes are kept entire until the moment of seizing the child. But, admitting spontaneous labour at term to be a favouring condition, may not labour artificially induced be equally favouring? It has been argued that by operating before term, the uterus, taken at a period prior to the highest degree of degeneration of its muscular fibres, would heal better. This is a physiological error; the degree of fatty change in the mature uterus is no impediment to repair. There are too many examples of union after section by the knife, and even after rupture, to admit of a doubt as to the capacity of the mature uterus to repair itself. Then, on the other hand, clinical experience proves that the uterus is also capable of complete repair at the seventh or eighth month of gestation.

We may then very properly consider whether, assuming things to be equal quoùd the uterus, there may not be other circumstances that may turn the scale in favour of premature

¹ Monatsschr. f. Grburtsk., 1863.

delivery. In some cases such circumstances undoubtedly exist.

There are certain cases in which we have no choice of time; we must operate on the instant emergency. There are cases, such as extreme distortion or malignant disease, in which—the induction of labour at a time to admit of delivery per vias naturales having passed by—it is better, in the interest of mother and child, to wait for the natural term of gestation. Looking at the probability of the operation proving fatal, it is clearly better to give the woman another month or two of life.

Upon the whole, the best course is to select a time as near the natural term of gestation as possible. Shall we start the labour as a preparation for the operation? The weight of reason seems to be in favour of operating upon a uterus in the act of labour. The first step, then, will be to pass up an elastic bougie into the nterus over-night, and to proceed to the operation next day. If the os uteri is not open more than enough to allow a finger to pass, it will be useful to dilate it a little more with the caoutchouc bag, No. 2. This will probably excite further uterine action, and it will secure a free outlet for discharges from the uterus.

The instruments and assistants. The instruments required are a catheter, a sharp bistouri, a bistouri having a blunt end, a director such as is used for ovariotomy, artery forceps and ligatures, needles, silk or catgut sutures for the uterine wound, the usual antiseptic apparatus and dressings, solution of perchloride of iron to arrest hæmorrhage from the placental site, a galvanic battery to excite uterine contraction, and a drainage tube. Assistants: A skilled assistant should stand on the side of the patient opposite to the operator. Another should be free to hand instruments and assist in spouging. The anæsthesia is, of course, entrusted to a special assistant. A nurse or two will complete the necessary staff.

The operation. A. Casarian section simple. The patient is laid on a table on her back, head and shoulders slightly raised. The operator stands on the patient's right. The catheter is passed. If the case be one of ostcomalacia, explore for the last time to ascertain if the pelvis can be opened up by the hand.

It is desirable to determine by auscultation the seat of attachment of the placenta. Pfeiffer noticed that a peculiar thrill or vibration marked the seat of the placenta, and this sign may receive confirmation by feeling the part bulging a little on the uterine spheroid.

The abdominal incision is then made in the linea alba from a little above the umbilicus to within two inches of the symphysis pubis. It is best extended upwards and downwards to the requisite extent by the strong ovariotomy scissors. Assistants support the abdominal wall on either side to prevent the escape of intestine. The uterus, being brought centrally to correspond with the abdominal incision, is incised in the middle line, sparing the fundus and lower segment as much as possible, as these parts are not so well adapted to contract, and large vessels are more likely to be divided. Circular fibres predominating near the cervix tend to make the wound gape. Winckel describes a manœuvre very useful in guarding against the bulging of intestine. He gets an assistant to hook a finger of each hand in the upper and lower angle of the uterine wound, and, lifting them up, fixes them in contact with the corresponding ends of the abdominal wound. This shuts in the intestine effectually, and helps to prevent blood from running into the abdominal cavity.

If the placenta is found directly behind the wound, the hand of the operator is insinuated between the placenta and the uterine wall, detaching it until the edge is felt. Then the membranes are pierced, and the child is seized by the feet. Sometimes in extraction the neck is tightly grasped by the uterine wound. If the constriction does not soon yield, it is better to extend the incision than to drag overmuch, or it may be best to deliver the head first.

Removal of placenta. If the uterus contract and cast off the placenta, the removal by hand is simple. But if the uterus remain flaccid, the peeling-off by the hand is sure to be attended by free hæmorrhage. In this case it is better not to hurry this stage, but to wait awhile, as we do after ordinary labour, to allow the uterus to recover power, and to excite it, if necessary, by galvanism or the ether spray. The placenta may be squeezed out by the two hands.

When child and placenta are removed, attention is required

to watch the bleeding. This may take place from the cut sinuses in the uterine walls and from the placental site. Hæmorrhage from the cut surfaces Fancourt Barnes found to be effectually controlled by Sydney Jones's ovariotomy clips. If hæmorrhage persist from the placental site, it will be necessary to swab it with perchloride of iron. Hæmorrhage is further controlled by pressure upon the uterus.

Before closing the uterine wound, thrust a probang, armed with a bit of sponge, through the eervix, to ensure free communication between the uterine cavity and the vagina.

The closure of the wound. When the bleeding has ceased, and the peritoneal cavity has been swabbed out, we have to consider the question of applying sutures to the uterine wound. It has been observed that in many fatal cases the edges of the wound have been gaping and flaccid. But in most of these cases the operation had been done on women exhausted by protraeted labour. On the other hand, in women operated upon at a selected time, the uterus commonly contracts well. But we must remember that, just as we find it to happen in ordinary post-partum hæmorrhage, the uterus may relax again after having been apparently well contracted. Many recoveries have lhappened without stitching the uterine wound. Winckel says lhe has never lost a case from hæmorrhage, and he has not stitched the wound. The 'suture sanglante,' so called, was used by Lebas de Mouilleron in 1769. Simpson, Spencer 'Wells, and others have used it, but the patients died.

Another principle has been followed—that is, to stitch the uterus and unite it by the sutures to the abdominal walls. Hieks and Tarnier each treated a case on this principle. Effusion was prevented. Uterine suture should meet the following conditions: It should stop hæmorrhage from the cut surfaces of the uterus; it should secure fair apposition of the wo lips of the uterine wound; it should keep the anterior wall of the uterus in apposition with the abdominal wall, so as o favour adhesion without dragging. This last condition is not so essential as the two first. Interrupted silk sutures, such as are used to stitch up wounded intestines, are best.

The abdominal wound is united by the interrupted suture of silk or silver wire as in ovariotomy.

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After-treatment. An opium suppository should be applied. Perfect repose and light nourishment are essential. The dressings should rarely be removed under five or six days. The sutures had better be left until the seventh or eighth day. The bowels may be relieved by enema of soap on the fourth day. It is necessary to wear a well-fitting firm abdominal belt for some months.

B. Porro's operation. The most remarkable fact in the history of the Cæsarian section is the introduction of the method known as Porro's. Cavallini, in 1768, instituted experiments on the removal of the pregnant uterus in bitches and ewes. Blundell made similar experiments, three out of four rabbits recovering. He says (1828): 'In speculative moments I have sometimes felt inclined to persuade myself that the dangers of the Cæsarian operation might be considerably diminished by the total removal of the uterus. Perhaps this method of operating may prove an eminent and valuable improvement.' Has subsequent history realised the idea? Porro, in 1876, first carried the proposal into execution by deliberately performing utero-ovarian amputation during Cæsarian section. His memoir, 'Della amputazione utero-ovarica come complemento di taglio Cesareo, 1876, is epochal. He has had four recoveries out of five operations.

It consists in the removal of the uterus and appendages by amputation through the cervix after extracting the child. It is claimed for it that it gives greater security against hemorrhage; there is no uterine wound to heal; there is less risk of septicæmia; and there is security against future pregnancy. The operation is performed by (1) making an abdominal incision; (2) laying open the uterus; (3) and extracting the child as in the ordinary Cæsarian section; then (4) drawing the emptied uterus out of the abdomen; (5) transfixing and ligating the uterus just below the os internum by Cintrat's or Koeberlé's serre-næud; (6) amputating the uterus with the ovaries and tubes just above the serre-næud; (7) securing the stump outside the abdominal wound by transfixing needles. The general rules of antiseptic surgery are observed. (8) The abdominal wound is closed as in ovariotomy.

In a case performed by Fancourt Barnes, all hæmorrhage from the wound of the uterus was effectually controlled by

seizing the cut edges with Sydney Jones's ovariotomy-clamps, so that very little blood need be lost.

Dr. Godson collected 138 cases. These gave 77 deaths against 61 recoveries—a very formidable result. We are unable to say whether this contrasts favourably or not with that of the simple Cæsarian section. The indications for the operation are generally the same. In Godson's case, which ended in recovery, the pelvis had been smashed in childhood. In Fancourt Barnes's case, the operation was called for by the blocking of the pelvis by an immovable dermoid cyst. The patient lived four days, and would probably have survived but for the changes undergone in the tumour, which was fixed to the pelvic wall.

One question not yet settled is whether it is better to secure the stump outside the abdomen or to drop it inside. Dr. Goode,² of Sydney, had a successful issue after the intraperitoneal method. But the results of this plan in ordinary hysterotomy are not encouraging.

Müller's modification of Porro consists in drawing out the whole uterus, with its contents, through the abdominal wound. Thus drawn out, the ligature is secured round the stump before the uterus is opened and the child extracted.

C. The operation of laparo-elytrotomy ($\lambda a\pi \acute{a}\rho a$, the flanks; έλυτρον, the vagina; and τομή, a cutting), revived by Dr. Gaillard Thomas, was originally performed by Von Ritgen and Baudelocque. It cousists in an incision, usually on the right side, through the abdominal wall, from above the spine of the pubes to above the anterior superior spine of the ilium—that is, along Poupart's ligament. The peritoneum is then raised, the fundus uteri is tilted down to the opposite side, the os uteri tilted up, and an incision made through the vaginal wall on to a probe or staff in the vagina. The child is then extracted through the os uteri and the vaginal wound. The wound in the flank is then united by sutures. Dr. Garrigues states that for the performance of this operation five assistants are desirable, four indispensable. The operation has been done eight times. Of these cases six were done in America by three operators: Drs. Thomas, Skene, and Gillette. In England, up to the present time, Drs. Hime and Edis alone have resorted to the

² Ibid., 1884.

operation—in both instances unsuccessfully. Of Dr. Thomas's two cases, one recovered. Of Dr. Skene's three cases, two recovered. Dr. Gillette's one case recovered. The mortality has therefore been four in eight cases. The chief drawback to the operation is the difficulty—we were almost saying the impossibility—in preventing injury to the bladder during the delivery of the child. In Dr. Edis's case, in the British Lying-in Hospital, the child weighed 7 lbs. 10 oz., and yet the bladder was ruptured. In four out of the cight cases just mentioned the bladder was injured. The epigastric artery may be wounded; this, however, is easily ligated. An important objection to the operation is that the mother may again become pregnant, and have to undergo similar dangers.

D. Casarian section plus removal of the ovaries. removal of the ovaries obviates the risk of future pregnancy. It appears to be the natural complement of the Cæsarian section. It is desirable to remove the Fallopian tubes at the same time. The parts are embraced in a clamp, and the stumps secured by ligatures. In other respects the operation

is the same as the simple section.

To furnish indications in the conduct of the Cæsarian section, it is desirable to keep in mind the more common

causes of death. These are:

1. If the operation is performed as the last resource after protracted attempts to deliver by other means, the woman is apt to sink from shock and exhaustion in a few hours. If she survive beyond a few hours, there is the risk of hæmorrhage, of metritis, peritonitis, gangrene, scpticæmia. It may be said that the prospect of recovery when the operation is performed under these circumstances is very small.

2. If the operation is performed at a selected time, the woman encounters the shock of the operation with unimpaired strength. Still the shock is great. It affects different persons in different degrees. It is an uncertain element of danger, and must probably ever perplex all calculation as to the result of the Cæsarian section in any particular case.

3. The next danger is hamorrhage. This is often associated with prostration as cause and as effect. It may come on within a few hours. It may flow from the placental site and from the uterine wound. It may kill by rapid anæmia, and by

causing irritation of the peritoneum. Closure of the wound by suture and inducing contraction of the uterus should obviate the hemorrhage. If not, styptics must be applied.

- 4. Secondary shock and peritonitis. Secondary shock may precede peritonitis. Intense pain, even tenderness on pressure, rapid small pulse, accelerated and impeded breathing, suggest the diagnosis of peritonitis. This condition Robert Barnes described as 'abdominal shock.' If at this stage the patient die and be examined, probably no trace of peritonitis, as revealed by redness or effusion, is discovered. Peritonitis may be manifest on the day following the operation.
 - 5. The next danger is septicamic puerperal fever.
- 6. In addition to the dangers incident to the operation and to the puerperal state, there is the danger inherent to the disease which rendered the operation necessary, especially in the case of cancer.

Winckel says that osteomalacia is much more unfavourable than rickets in connection with Cæsarian section.

The uterus often contracts adhesions with the abdominal wall during repair. These adhesions do not appear to entail serious inconvenience, and should pregnancy again occur, and the Cæsarian section be again necessary, they render the operation less dangerous (Meigs). The peritoneal cavity is shut off; the incision through the abdominal wall leads directly through the adhesions to the uterus. Thus some of the usual dangers are eliminated. This result would be favoured by uterine suture and uniting the uterus to the abdominal wall. On the other hand, no adhesions may be found, and the uterine wound may heal so completely that years afterwards no trace of cicatrix is found. Again, there may remain a marked cicatrix, free from adhesions, as in Newman's case, figured in the 'Obstetrical Operations.'

Several cases are known in which the operation has been performed twice, thrice, and even four times on the same woman. These cases seem to indicate a special tolerance in the subjects. They cannot be accepted as evidence, absolute or cumulative and statistical, in reduction of the danger of the operation. The following history by Frierichs is instructive. He performed the section on account of contracted pelvis.

¹ Nederl. Tijdschr. r. Geneeskunde, 1858.

Mother and child recovered. Again pregnant, premature labour was induced at about the eighth month. When labour had begun, collapse set in; the uterus had ruptured. The child was removed by abdominal section. Vomiting caused extrusion of the intestines. To effect reposition numerous pricks were made in them with a bistouri, and much thin pappy matter escaped. The intestines were then replaced and the wound closed. How many women would be as tolerant?

Comparative appreciation of the several operations. Shock is inherent to all. It is greater in Porro's operation. Hæmorrhage is especially dangerous in the Cæsarian section simple; it may be practically excluded in Porro's operation. The danger of escape of blood or irritating matters into the peritoneum is serious in the simple section, and excluded in Porro's method. Müller's modification of Porro's operation is of doubtful value. Little or nothing is saved in hæmorrhage. It has been found difficult to draw the full uterus through a very free abdominal wound. Greater shock is entailed. Laparo-elytrotomy has the advantage of not opening the peritoneal cavity; but if the cervix uteri is not dilated enough, time may be lost in dilating before the child can be extracted. The child's chance is less, the mother's not greater than in Porro's operation. And there is the serious risk of injuring the bladder. Cæsarian section plus the removal of the ovaries has the obvious advantage, like Porro's method, of excluding the danger of future pregnancies; it entails less mutilation, and if we could be secure against hæmorrhage it would in many cases be preferable. Porro's method is especially indicated when there is disease of the uterus, or when tumour blocks the pelvis.

Symphysiotomy—the Sigaultian operation—has been devised as an alternative for the Cæsarian section. This proceeding is based upon the fact of the natural relaxation of the pelvic joints in pregnancy and labour. If it be admitted that the pelvic ring expands a little under the distending action of the child in passing, might not a similar end be attained by dividing the symphysis pubis, and thus opening the pelvis in a manner similar to what takes place in guineapigs?

The operation is never mentioned in English works unless

to be condemned. It has at various times been regarded as obsolete. The subject is well discussed by Scanzoni and by Lovati (Del parto meccanico). Signult maintained that an inch was gained by it. Leroy gained two and a half inches. Baudelocque and Desgranges in their experiments gained a space between the pubic surfaces of two and a half inches. They say that every half inch of distance between the pubic surfaces gives one line of conjugate diameter—therefore two inches give four lines; then, if the parietal protuberance be made to project into the inter-pubic space, two lines more are gained; the oblique diameter gains eight lines; the transverse gains half the distance between the pubic bones—that is, one inch. The operation might therefore be available in cases where a gain of six lines will enable a live child to pass, or where a head impacted in the brim might be liberated without perforation. In either case extraction by forceps would still be necessary.

The operation has in recent years been revived in Italy. Morisani gives statistics of fifty cases performed on forty-eight women between 1868 and 1881; the principal operators being Novi, Martini, and Morisani. Forty mothers and forty-one children survived. He considers that it is less dangerous than embryotomy. The deaths of mothers are not more numerous, and the children saved are a clear gain. It may be objected that the deaths from embryotomy are much overstated. His method is as follows: He uses a small crotchet-shaped knife, curved, and cutting on its concave edge; it is known as the falcetta di Galbiati. An incision of from 3 to 5 centim. is made just above the symphysis pubis. The articulation is gradually reached, the falcetta is slipped along the posterior surface of the symphysis, and when the lower edge of the symphysis is reached, the cutting concavity of the instrument is hooked under the interpubic cartilage, which is then cut through from below upwards. If the uterine contractions are strong, the expulsion of the child is allowed to take place spontaneously. If they are feeble, the forceps is applied. Lastly, the wound is dressed, and immobility of the pelvis is secured by an appropriate bandage.

Symphysiotomy, notwithstanding this favourable report, will probably not make way in practice as an alternative for the

Cæsarian section or for embryotomy. Scanzoni says the only case in which it is justifiable is where the mother dies in labour, the child being partly born, and extrication difficult without enlargement of the pelvis.

The mother will probably remain lame.

CHAPTER XVI.

THE PREMATURE INDUCTION OF LABOUR: DEFINITION; HISTORICAL NOTE; CONDITIONS UNDER WHICH CARRIED OUT; PROCESS AND OPERATION; PROVOCATIVE AND ACCELERATIVE MEANS; INDICATIONS FOR OPERATION; DISTINCTION BETWEEN INDUCTION OF ABORTION AND PREMATURE LABOUR; MODIFICATIONS OF OPERATION; IN PELVIC DEFORMITY; URGENT DANGER OF MOTHER; CONVULSIONS, CHOREA, HEART AND LUNG DISEASE; HÆMORRHAGES; TO SAVE THE CHILD; INTRA-UTERINE DISEASE; ETHICAL CASES; CONCLUSION.

By the premature induction of labour we are carried back within the range of conservative obstetrics. By this operation we anticipate some of the dangers which mother and child would encounter in labour at term.

The recognition of the operation as a legitimate resource of conservative obstetrics dates from 1756, when, says Denman, 'there was a consultation of the most eminent men at that time in London to consider the moral rectitude of, and the advantages which might be expected from, this practice.' It met with their general approbation. It has since encountered much opposition, chiefly in Roman Catholic countries, science contending in the interest of humanity from her point of view, and religion from hers. The general tendency has been to show that these views are not really antagonistic; and thus the operation now generally commands the sanction of science and religion.

Definitions. The premature induction of labour is the artificial arrest of gestation when seven months are completed, when the child has reached viability. The induction of abortion is the artificial arrest of gestation in the earlier months before the child is viable.

The first operation is designed to rescue both mother and

child, or at least the child, when it is more especially in danger. The second operation is designed solely in the interest of the mother.

It is important to consider the general conditions under which the operations have to be carried out.

- 1. The fitness of the general system to enter upon labour and puerpery. The nervous, circulatory, and glandular systems are imperfectly developed. This imperfect preparation we must accept. In reality the system is generally fairly competent to carry through the duty imposed upon it.
- 2. The uterus is immature. This involves imperfect contractile power, and imperfect dilatability of the cervix uteri.
- 3. The defect of uterine development is partly compensated by the child being smaller and more plastic. On the other hand, abnormal presentations are more frequent. Most of the accidents that may complicate labour and puerpery at term may complicate premature labour and abortion.

We must, then, bear in mind that when labour is provoked, the system, generally, and the uterus are taken by surprise.

Relation of the proceeding to the mechanism of labour. By labour at seven months, contraction of the pelvis according to advancing degrees, spontaneous labour may supersede the forceps, the forceps may supersede turning, turning craniotomy, craniotomy the Cæsarian section, and the Cæsarian section may be eliminated (see table, p. 582).

The motive principle is to bring the two factors, the body to be expelled, and the resisting force, into approximate relation.

Relation to the systemic condition. 1. Developmental attraction of blood to the pelvis is stopped. 2. Vascular tension is reduced. 3. Nervous tension is reduced. Hence morbid processes which are aggravated by high nervous and vascular tension are eased.

The process of artificial labour. It may be divided into two distinct stages: (1) Provocative; (2) accelerative.

1. Provocative measures. Action has been too exclusively limited to provocation. The provocative measures may be divided into (a) medicinal; (b) topical or instrumental. (a) Medicinal agents act mainly upon the spinal centre, some to a certain extent directly upon the uterine irritability. The principal medicinal agents are ergot, savin, quinia, hamamelis,

borax, einnamon. We will not dwell upon these, since their action is extremely uncertain. It is, however, well to remember that all these drugs aet much more surely upon women in hot climates. (b) Some agents evoke the energics of the diastaltic system by stimulating various peripheral nerves. Such are rectal injections, the vaginal douche, the colpeurynter or water-bag in the vagina, the plug, or tampon, or water-bags in the cervix uteri, the separation of the membranes, intra-uterine douche, the evacuation of the liquor amnii, injection of earbonic acid into the uterus, the introduction of bougies into the body of the uterus, faradisation; the irritation of the breasts by sinapisms, or the air-pnmp. Some of these agents act also partly by direct mechanical force, dilating the vagina and cervix. This is the case with the tampon and the water-bags.

Appreciation of these methods. Faradisation, at first sight, would seem to be the most scientific. Herder suggested this method of causing the uterus to expel its contents in 1803. In 1844 Hörninger and Jacoby brought on labour by it. Radford showed its value in labour and in controlling hæmorrhage. In 1853 Robert Barnes published a memoir on this subject. He succeeded in three cases in provoking labour by it. But he found the method tedious, and sometimes distressing to the patient. One pole was applied to the cervix uteri, the other on the abdomen over the uterus. On making the contact the bladder would contract, thus showing the influence upon the hollow organs. Recently, Dr. Kilner has revived the method, and in his hands, with improved apparatus, it seems to promise better results.

The douche, vaginal and uterine. The vaginal douche is known as Kiwisch's plan. It consists in playing a stream of water against the cervix uteri. It is often tedious, and not free from danger. It requires to be repeated at intervals during several days. It is liable to cause eongestion of the lower segment of the uterus. Serious shock, metritis, and death have followed. It was adopted by Tyler Smith, until he encountered a fatal result.

The intra-utcrine douche is sometimes spoken of as Kiwisch's plan. It was recommended by Schweighaüser in 1825, and

¹ Obst. Trans., 1884.

practised by Cohen in 1846. It is known in Germany as Cohen's method. It consists in passing a tube fairly into the uterine cavity. Different operators have passed the tube to different distances. Although more certain to provoke labour, it is even more daugerous than the vaginal douche. Fatal cases have been recorded by Lazzati, Salmon, Depaul, Blot, Tarnier, Esterlé, Ulrich, J. C. Dalton, and others. The references are given in the 'Obstetric Operations,' 3rd ed. The cause of death appears in some cases to have been shock; in others, air has got into the veins and heart.

Of course no degree of efficiency could justify the use of a method fraught with such terrible danger. But it does not possess even the merit of certainty. Lazzati tried it in thirty-six cases, and found that from one to twelve injections were required, and that the time expended varied from one to fourteen days. It was also found that a large proportion of children were lost. The douche therefore, vaginal or uterine, ought to be absolutely condemned. We repeat this emphatically, because the method is still taught and practised.

It must be uoted, however, that Mr. James 1 and Lazarewitch,2 contending that the seat of greatest irritability of the uterus is the fundus, recommended that the tube should be carried to that regiou, and then to inject. James injected about eight ounces of cold water. Of eight children oulv two were stillborn. Lazarewitch reported twelve cases. It may be admitted that this method is more sure than other modes of applying the douche; but the cases are too few to prove that it is safe. We feel sure that if it be at all frequently adopted, fatal catastrophes will ensue. It may, moreover, be doubted whether, in cases managed on the principle of applying irritation to the fundus uteri, the injection of water is not superfluous. The passage of a catheter five or six inches into the uterus detaches the membranes along its course, and this is usually quite enough to provoke labour. Why uot, then, rest satisfied with that part of the proceeding which is safe and efficient, and discard that part which is superfluous and dangerous?

It is instructive to compare the historics of some cases of intra-uterine injection with those of intra-uterine hæmorrliage

¹ Lancet, 1861.

² Obst. Trans., 1868.

from detachment of placenta. Sudden severe pain in the abdomen at the seat of effusion, shivering, vomiting, collapse, are observed in both cases. In the case of hæmorrhage, these symptoms are certainly not in proportion to, or due alone to, the loss of blood. They seem to be the direct effect of injury to the uterus from sudden distension of fibre. The uterus will grow to keep pace with developmental stimulus of a body contained in it, but it will not stretch to accommodate several cubic inches of fluid suddenly thrown into it. Yet this is what it is called upon to do when water is injected. If the water escape as fast as it enters, the shock may be avoided; but then the operation is liable to fail in inducing labour.

The injection of carbonic acid gas or even common air seems more dangerous still. Carbonic acid excites muscle to contract. Hence the motive of its application. Scanzoni relates two fatal cases from injection of carbonic acid. J. Y. Simpson relates one where the patient died in a few minutes after the injection of common air.

Another method of provoking labour consists in dilating or irritating the cervix uteri. Many contrivances have been proposed. The principal are the sponge-tent, the laminariatent, the elastic air or water-bag. Labour sometimes indeed follows their use. But the result is extremely uncertain, and often tedious. In most cases some further means, as rupturing the membranes, will be necessary. The laminaria-tent is, however, useful in expediting the dilatation and evacuation of the uterus in some cases of abortion. It must, however, be stated that pyæmic symptoms have resulted from the foul discharges caused by the tents. This accident might perhaps be obviated by the use of tents charged with antiscptic agents. Many instruments made to expand on the principle of urethral dilators have been adapted to the purpose of dilating the cervix. As a means of inducing labour they are not to be trusted.

The method known as Hamilton's, which consists in detaching the membranes of the ovum from the lower segment of the uterus, has the recommendation of safety; but it is uncertain in its operation.

The introduction of a bougie into the uterus, sometimes called Krause's method, is of all methods that which combines certainty and safety in the highest degree. A bougie is slowly

passed up between the uterinc wall and the membranes, until the point is presumed to reach the fundus, the most irritable part of the uterus. Two things are done: the membranes are detached along the course of the bougic; and the presence of the bougie acts as an excitant. The bougie should be passed at least six or seven inches through the os. Probably in many cases in which the proceeding has failed, the bougic had only penetrated a short way. By passing the bougie, lubricated. gently, letting it worm its way, it will naturally run between the membranes and the uterine wall where there is least resistance, turning round the edge of the placenta. The bougie must be left in situ for several hours. Spiegelberg, however, says that there is danger of air getting into the uterine cavity, and of infection, and this whether a catheter or a solid bougic be used. We always use an elastic bougie, well soaked in carbolic solution. We have never met with any accident, and still adhere to the recommendation of the method we gave in the 'Obstetric Operations' many years ago.

Puncturing the membranes is practised in two ways. The direct puncture at the point opposite the os uteri is probably the oldest method of inducing labour. It is the surest. It is not in itself dangerous. The immediate effect of draining off the liquor amnii is to cause concentric collapse of the uterine walls, diminishing its cavity in adaptation to its diminished contents. This probably involves some disturbance in the utero-placental circulation. The parts of the fœtus come into contact with the uterine wall. Hence uterine contraction is promoted both by diastaltic excitation, and by the impulse given by the concentric collapse.

In certain cases this plan of direct puncture is the most convenient, as where the object is to lessen the bulk of the uterus and ensure labour quickly. But it is open to the following objection: it is an inversion of the natural order of parturient events. Some uterine action, lubrication, and expansion of the cervix ought to precede the evacuation of liquor amnii. If this order be not observed, the child is apt to be driven down upon the unyielding cervix, and the uterus, still contracting concentrically, compresses the child and kills it. And this is all the more likely to happen in premature

labour, from the greater liability to shoulder-presentation and descent of the funis.

This objection is to some extent obviated by a modification of the method. Hopkins recommended to pass the sound some distance between the ovum and the uterine walls, and then to tap the amniotic sac at a point remote from the os. In this way the liquor amnii would escape gradually. It is an important improvement, and it is still adopted in this country and in Germany.

Vaginal dilatation. In 1842 Hüter described a method of exciting labour by placing a calf's bladder smeared with oil of hyoscyamus in the vagina and distending it with warm water. This proceeding he repeated every day until labour set in, which usually happened in from three to seven days. Braun substituted a caoutchouc bladder, to which he gave the name colpeurynter. This was adopted by several German professors. Another form of vaginal dilator is the air-pessary of Gariel. Accidents, of a fatal character in some instances, have followed the use of these instruments. But we cannot think that danger is inherent in the method if carefully carried out. Still, the principle of vaginal dilatation is unsound.

The successful application of fluid pressure as a means of dilating the cervix is mainly due to Robert Barnes, whose water-bags have long been in extensive use. Keiller and Jardine Murray had previously employed caoutchouc bags. But these appear to have been introduced inside the cavity of the uterus proper. Murray published a case of placenta prævia. Having first detached the placenta from the lower zone on Barnes's plan, he introduced a flattened air-pessary between the wall of the uterns and the presenting surface of the placenta, and inflated it by a syringe. In the same year Dr. Storer published a case in which he introduced 'the uterine dilator' within the cavity of the uterus. He especially insisted that the dilatation was 'from above downwards.' Tarnier also (1862) contrived an intra-uterine dilator designed to expand the lower segment of the utcrus. This is a distinctly different principle from that which Barnes worked upon. He pointed out certain faults inherent in all elastic bags which expand inside the uterus, even more serious than those which mark the vaginal dilators or Braun's colpourynter. It is the cervix

¹ Med. Times and Gaz., 1859.

that wants dilating. A bag that expands below it in the vagina, or above it in the uterus, can only act upon it indirectly, imperfectly, and uncertainly. The uterine dilator. moreover, is unsafe; during dilatation it must stretch the uterine wall at the risk of injury and shock, and it is very likely to displace the head from the os uteri. We have never seen the dilators of Keiller and Murray, but from the accounts published we are justified in regarding them as unfit to dilate the cervix. The form now used (see fig. 55, p. 508) was perfected, after much difficulty from instrument makers, before the models of Tarnier, Keiller, and others had been made known. The constriction in the middle is seized by the cervix, whilst the two expanding ends serve to prevent the bag from slipping up into the uterus, or down into the vagina. It imitates in its action very closely the bag of liquor amnii. By its aid the cervix may be expanded sufficiently to admit of delivery within an hour, although it is generally desirable to proceed more slowly. In cases of placenta prævia we have effected adequate dilatation in half an hour, when time was precious.

The proceeding recommended. Having discussed the various methods of provoking labour, we are now in a position to select the most safe, convenient, and efficient. The plan we have successfully practised for many years is the following: First, overnight, pass an elastic bougie, No. 9 or 10, lubricated with carbolised vaseline, as far as it will go into the uterus, and coil up the remainder in the fundus of the vagina. It will thus keep in situ. By next morning some uterine action will have set in. The uterine neck and the vagina will be found soft and freely lubricated with mucus, and some expansion of the cervix will have taken place. The bougie should be kept in its place until the child is ready to pass. This is provocation. In the afternoon, at an appointed time, we may proceed, if desirable, to accelerative measures.

Before rupturing the membranes, adapt a binder to the abdomen, and let this be tightened so as to keep the head in close apposition to the cervix. This will often prevent the cord from being washed down by the rush of liquor amnii. The cervix is then dilated by the medium, or large, water-bag until it will admit three or four fingers. Then rupture the membranes, and before all the liquor annii has escaped,

introduce the water-bag again, and expand until the uterns is open for the passage of the child. If the presentation is natural, if there is room, and if there are pains, leave the rest to Nature, simply watching the progress of the labour. If these conditions are not present, and one or other is likely to be wanting, proceed with accelerative measures—that is, to the forceps or turning, or, in eases where the passage of a live child is hopeless, to craniotomy.

By pursuing this method we may anticipate with great accuracy the term of the labour. Twenty-four hours in all, counting from the insertion of the bougie, should see the completion of the labour. But the proceeding must vary according to the conditions of the case. In many cases it is desirable, it being clear that the child is not imperilled by delay, to allow dilatation and expulsion to be effected as far as possible spontaneously. We must recollect that safety is best secured by obtaining such dilatation of the soft parts that the child may pass easily and quickly. But if urgency dictate, labour may be accomplished at a predetermined hour and at one sitting.

Indications for the induction of labour. It is strictly a medical question, ruled by considerations for the interest of (1) the mother and child; (2) of the mother; (3) of the child. Gestation may be divided into two parts. During the first part, terminating at six and a half to seven months, or at the end of 180 or 200 days, it is scarcely probable that a viable child will be born. To induce labour within this period is really to induce abortion. It is therefore only done under the pressure of conditions that preclude waiting until the child is viable, and ont of regard solely to the safety of the mother. Between 200 and 230 days is a stage of very doubtful viability, and the physician will still endeavour to postpone interference until after the latter date, when the operation may be undertaken with more confidence of saving the offspring as well as the mother.

The selection of the time is determined by obstetric conditions that will be pointed ont. But a certain range is generally permitted. Storer, in a Memoir on Uterine Ebb, as a factor in pelvic surgery, says: 'We may wish to induce labour, and to our surprise may again and again introduce the sound fairly to

the fundus, sweeping the membranes from the uterine wall, but without the slightest result. We shall then discover that we have selected the uterine ebb. We wait for a few days till the flow has again commenced, and we find the labour induced by the most trifling cause.' Hence, we should select when we can a menstrual epoch.

In a large proportion of eases we may within certain limits select our time. For example, when there is moderate pelvic contraction, admitting of the safe passage of a child a little below the full size, we may be justified in waiting until the end of eight months, say 250 days. The difficulty is to determine the starting point of the pregnancy. There is a probable range of error of fifteen days. If we count fifteen days too many, we reduce the duration of gestation to 235 days—that is, we may fall within the period of doubtful viability. If, on the other hand, we count fifteen days too few, we run the risk of having to deal with a child too large to pass the narrow pelvis alive.

The best way perhaps of steering between these two rocks is to reekon the pregnancy from the day after the eessation of the last menstrual epoch, the most probable time of conception. Count 230 days from that epoch, and add twenty days for a margin of safety. This will leave a full month to complete the development of the child. The cases are few, if all the resources for accelerating labour arc turned to account, in which a child of 250 days may not be delivered alive. But if we fall upon a child of 215 days or less, the chances of its survival are small. The error of procrastination is generally of less moment than the error of anticipation. Of course if the pelvic contraction is great, say to 2.50 inches, it will be prudent not to calculate beyond 240 days, but rather to incur the risk of bringing forth a non-viable child.

Ahlfeld proposes the following scheme for estimating the size of the fœtus, and thence the stage of gestation. The long axis of the fœtus when flexed in utero, he says, is nearly half the entire length when extended. Thus, if we measure the axis in utero by a pelvimeter, one point of which is applied by the vagina to the fœtal head, and the other on the fundus uteri where the breech is felt, we get the first element in the problem, and doubling the length so obtained, we get the total length of the extended child, the second element. Now, if we

assume a definite relation of length of child to the period of gestation, we have the index required. For example, let the axis obtained be 9 inches, $9 \times 2 = 18$ inches, the total length of the child. This corresponds to the thirty-first to the thirty-fourth week of gestation. The range of probable error is too great to admit of much reliance upon this method. There are four factors, if not more, which must be determined with some precision in order to base trustworthy calculations: the size of the child, the development of the cranium, the date of the gestation, and the dimensions and shape of the pelvis. Seldom can one of these factors be determined with precision; we shall certainly fail in determining all. And if we could determine all, we could not count upon a fixed correlation.

We may first enumerate those conditions which in the interest of the mother demand the interruption of gestation during the first part—that is, the induction of abortion. These are: A. Certain eases of extreme contraction in the bony or soft parts—e.g. distortion and narrowing of the pelvis below 2.00 inches; the encroachment of considerable tumours, especially if they are unyielding, upon the pelvic eanal; some cases of advancing cystic disease of the ovary; great contraction from cicatrices of the cervix uteri and vagina, not admitting of free dilatation; some cases of carcinoma of the uterus or vagina; some tumours of the uterus; retroflexion or retroversion of the uterus that cannot be reduced, or when uraemia complicates; fixing of the uterus from adhesions.

B. Certain cases of urgent disease, depending upon and complicating gestation—e.g. obstinate vomiting with progressive emaciation, and a pulse persistent for some days above 120; some cases of advancing jaundice with diarrhœa; some cases of albuminuria, especially if convulsions attend; some cases of insanity or of chorea; hæmorrhages producing marked anæmia, especially if due to placenta prævia; some cases of heart-disease or lung-disease, attended with extreme dyspnæa, such as aneurism, hypertrophy, valvular disease, ædema of the lungs, pleurisy, pneumonia.

Under many of the conditions cited, Nature herself will be likely to induce abortion. If we have been fortunate enough to carry the patient over the first part of gestation, we may still be compelled to induce labour.

Our experience leads us to conclude that in cases of urgent disease there is more frequent occasion to regret having delayed the operation too long than having had recourse to it too soon. When through obstinate vomiting, for example, nutrition has long been arrested, the starved tissues, craving for supplies and falling into disintegration, feed the blood with degraded and noxious materials; the system feeds upon itself and poisons itself; the poisoned blood irritates the nervous centres, and these centres, wrought to a state of extreme irritability, respond to the slightest peripheral, uterine, or emotional excitation. All nervous energy is thus diverted from its natural destination, and exhausted in destructive morbid action. Irritative fever ensues; the pulse rises to 140 or more. No organ is capable of performing its functions properly, for the pabulum of life is cut off at the very source. At this point labour, whether it occur spontaneously or be induced by art, comes too late. The tissues are altered, the powers are impaired beyond recovery, and death soon follows delivery.

The question of inducing abortion being past, we have to enumerate the conditions which call for the induction of labour. The most generally recognised indication is such a degree of pelvic deformity as forbids the prospect of delivering a live child at term. In these cases the proceeding is an alternative for Cæsarian section and craniotomy.

In many cases we are left to determine upon the expediency of inducing labour by the history of antecedent labours. Where craniotomy has been performed on account of contracted pelvis clearly recognised, there can be little ground for doubt. But why should one or more children be sacrificed in order to teach the physician that the pelvis is too small? A woman pregnant for the first time is entitled to the benefit of the operation, if it be known that her pelvis is too small. The difficulty is to know this. The opportunity of making an obstetric estimate of the pelvis before labour is rarely afforded. The first labour at term is the common practical test of a woman's aptitude for child-bearing.

The object to be attained is the reduction of one of the factors of labour into due relation with the other. The pelvis being a fixed quantity, the alternative is to bring the child through it at an early stage of development. The table

(p. 582) shows how the scale of operations, arranged in the order of their severity as applied at term, may be slided down, so that when applied to labour at seven months, spontaneous labour supersedes the forceps, the forceps turning, turning craniotomy, and craniotomy the Cæsarian section, so that the Cæsarian section is eliminated.

Incidentally, a mode of seeking to reduce the bulk of the child may be mentioned. It is starving the patient, in the hope of arresting the development of the child. No reliance can be placed upon this method. Sedgwick relates a case of obstinate vomiting, in which nutrition was reduced to the lowest point compatible with life. Gestation ended in labour at term, when a healthy child was born quite unaffected by the severe regimen of its mother. It seems that the organism in utero will attract to itself all it can get, even at the sacrifice of the parent. This is often illustrated in phthisical women, who, emaciated to the last degree, almost dying of exhaustion, bring forth plump children.

The modifications of the proceedings to be adopted in different cases are: 1. In the case of pelvic deformity not admitting of the birth of a live child at term. Three degrees of contraction must be considered:—

The first, or least, degree—say, giving a conjugate of 3.50 inches. In such a case a child of seven or eight months' development will probably pass without much difficulty at seven months. Here it may be enough to provoke the labour, and watch its course.

The second degree, giving a conjugate of 3.00 inches. Here, unless the child be very small or timely aid be given, its head may be delayed so long in the brim that it will be lost. It will be proper to provoke labour by inserting the elastic bougie over-night; to accelerate labour by dilating the cervix, rupturing the membranes, applying the forceps, or turning.

The third degree, the conjugate being below 3.00 inches, may possibly admit the forceps; but it may be necessary to

turn, or to perforatc.

By inducing labour we get a head smaller and more plastic. Ossification proceeds rapidly during the last month of gestation. The advantage of increased plasticity is especially seen

¹ St. Thomas's Hospital Reports, 1876.

in those eases in which turning is resorted to. The course to pursue is as follows: If the uterus act with sufficient power, and the pelvie contraction be not so great as to impede the passage of the child's head, and the eord do not fall through. watch and let Nature do her work. But if the head be delayed, or the cord fall through, we must intervene. We may first try the forceps. But in most cases turning is better. The explanation is this: The smaller and more plastic head is eaught at the smaller or bi-temporal diameter between the projecting promontory and the symphysis pubis; the jutting promontory leaves abundant room on either side in the sacroiliac recess for the eord to lie protected from pressure; and if care be taken that the cervix uteri be adequately expanded, the head comes through so quickly that the dauger of asphyxia is not great. The mode of turning deserves attention. The object being to secure quick delivery, the soft passages must be well prepared. We might turn by the bi-polar method, without passing more than two fingers through the os uteri. But we have found it better to pass the greater part of the hand through the cervix to grasp the further knee. The cervix that will admit the hand will probably permit the ready transit of the child. We thus test and secure adequate dilatation.

When turning is completed, extraction must follow. should be done gently, drawing upon the one leg until the breech has passed the outlet; the extraction of the trunk should be slow; a loop of cord should be drawn down to take off tension. If the arms run up by the sides of the head they must be quiekly liberated. The rules given for this operation are of extreme importance in this case (see p. 649). When the arms are liberated, another difficulty arises: the neck of the child is in danger of being gripped in the ring of the cervix. This is the moment for acceleration. The two legs are held at the ankles by the left hand, whilst the right-hand fingers are crutehed over the back of the neck. The head is sure to enter the contracted brim in the transverse diameter. It has then to take the course of Barnes's curve. Traction must, therefore, be at first earefully backwards in the direction of this curve sò as to bring the head round and under the promontory. When it has cleared the strait, and is in the pelvis, the occiput commonly comes forward, and traction is changed

to the direction of Carus's curve to bring the head through the outlet. Unless rigorous attention is paid to this rule, so much time may be lost as to imperil the success of the operation. In eases of extreme deformity, in which it is difficult to perforate or to seize a leg, if labour has been induced at six months, the fœtus may still pass if we give time. After making a reasonable effort to snare a foot by manipulation and the wire-écraseur, if we leave the uterus to act for twelve hours or more, the child having perished and become moulded, some part of it, a foot or a shoulder, will come within reach. This can be drawn down; the head can be perforated, and then delivery is effected by traction. The placenta should also, if not following readily, be left a little while, and then squeezed out. In this way, Robert Barnes delivered in St. Thomas's Hespital a six months' feetus in a case of great osteomalacic deformity, in which it was impossible to get two fingers through the brim. The woman did well. This course applies especially to cases of osteomalacia in which some amount of yielding or unfolding of the pelvic bones may be obtained.

In other cases of extreme deformity, delivery may be effected after craniotomy, removal of the cranial vault, flattening of the remains of the bones upon the basis cranii, and extrac-

tion in the discoid state (see p. 688).

Certain cases of urgent distress of the mother produced or aggravated by high vascular and nervous tension may call for the induction of labour. Such are uncontrollable vomiting; advancing jaundice; albuminuria, especially if attended by convulsions; some cases of insanity or chorea; hæmorrhage, especially if from placenta prævia or of the 'accidental' kind; diseases of the heart or lungs entailing urgent dyspnæa. These cases have all been carefully discussed in the chapter on the 'Diseases of Gestation,' Vol. I.

It is useful to insist again upon the case of convulsions. Prompt action is imperative. It has been seen over and over again that the convulsions have ceased soon after the uterns has been emptied. The nervous and vascular tension quickly fall. Everything proves that the convulsions are due to conditions arising out of the pregnancy. What then more logical than to terminate the pregnancy? Yet experience suggests caution as to the mode of acting. In not a few cases labour

has failed to put an end to the convulsions. In other cases death has followed labour, whether this have occurred spontaneously or have been induced. Is the unfortunate issue the cousequence of procrastination in inducing labour, or of overhaste or want of precaution in the mode of proceeding? It is due sometimes to one cause, sometimes to the other.

The question of inducing labour before the actual outbreak of convulsions does not often come practically before us. If we are brought face to face with the pre-albuminuric stage or the albuminuric stage, the question must be carefully weighed. In some such cases the induction of labour would be a wise proceeding. When convulsions have broken out, it is rarely wise to hesitate. Is the operation to be carried out citissime? Is it to be done slowly and deliberately? The latter principle is the more judicious. The proceedings should involve the least possible operative interference. In the first place all should be conducted under chloroform. The membranes should be punctured. This at once lessons the bulk of the uterus, and diminishes the pressure upon the abdomiual vessels. The cervix should next be carefully dilated by the hydrostatic dilators; and then, according to circumstauces, we may wait a while, or accelerate the delivery by forceps, turning, or even by

A similar course will be proper in cases of *chorea* or urgent distress from *heart-disease*. In the case of dangerous vomiting in the early months, it will be useful as a preliminary measure to insert a laminaria tent into the cervix.

In retroversion of the uterus, irreducible and with urgent symptoms, the puncture of the membranes is the proper course. Immediate relief is gained by the concentric diminution of the volume of the uterus.

Fixing of the uterus by perimetric adhesions may indicate induction of abortion or labour. Laceration or other mischief might arise during the development of the uterus. A case in illustration occurred at St. Bartholomew's Hospital. Adhesions may, however, disappear under gradual stretching.

There are cases in which the induction of labour, or rather the emptying of the uterus, is indicated in order to remove a dead child. Usually expulsive action is set up spontaneously within

a week of the death of the fœtus. It will rarely be postponed beyond three weeks; but occasionally a much longer time has elapsed. There is a tendency to postpone the act of labour until the expiration of nine months. And then there is the case of 'missed labour,' in which labour may be indefinitely postponed. This subject has been discussed in Chapter XII., Vol. I. With the death of the fœtus, nervous and vascular tension fall. The uterus will commonly have lost much of its contractility and other properties peculiar to pregnancy. Simple provocative means may be totally inefficient. The cervix may have to be dilated by faggots of laminaria tents, and the child extracted piecemeal, perhaps at several sittings.

There are cases in which the indication is simply or primarily to save the child. Certain conditions tend to kill the child before the term of gestation. If we can bring the child into the world before the anticipated period of its death in utero, we may hope, by bringing it under fresh influences, to save it. Denman gives a case of a woman who lost two children about the eighth month, a rigor preceding. He suggested the induction of labour. Various diseases endanger the fœtus as they advance. Such are hydrocephalus, syphilis, fatty degeneration, hypertrophy, dropsy of the placenta. The child, if

rescued alive, may be successfully treated and reared.

The prognosis for the mother in fitting cases free from accidental complications is good, probably as good as that of ordinary labour. The prospect of the child is very fair, but it cannot be predicted with any confidence. The chances of error in the date of gestation, in the estimate of its viability, and the unusual conditions attending delivery are so many, that the best efforts may be baffled. And then a considerable proportion of the children born alive perish within a short time after birth from immaturity. Hence the most vigilant care is necessary in the treatment of the child. The couveuse or an equivalent should be prepared. Warm air to breathe, warmth to the surface, are essential. And we should be prepared to resuscitate from asphyxia.

Anticipation of the term of gestation is also indicated when a woman has brought forth unusually large or unduly ossified children; and especially when it is suspected that gestation is

protracted.

There are cases in which the wisest medical and ethical judgment is required. Some difficult cases may be stated. A woman pregnant about six months is dying of phthisis. Would it prolong her life or improve her condition if labour were induced? Should we be justified in sacrificing the child with that object? Or state another case: A woman threatened with imminent death by phthisis has attained the time when the fœtus is viable; shall we be justified in inducing labour, and perhaps accelerating her death, for the sake of rescuing her child? The relations of phthisis to gestation have been discussed in the chapter on the Diseases of Gestation (Vol. I.). It was long thought, and some people still believe, that pregnancy is antagonistic to the advance of phthisis. If this were true, the course would be obvious. Let the pregnancy alone. We believe, however, that pregnancy exerts no beneficial influence. Still clinical experience gives strong evidence in favour of expectation. Pregnancy is commonly less trying to a phthisical patient than labour and puerpery. The puerperal process throws such an increase of work upon the circulation, that the system often breaks down under the trial. Again, the proguosis in phthisis, even in cases apparently the most desperate, is often open to grave fallacy. Who has not seen patients, whose days were counted, survive for months, even for years? In the interest, then, of mother and child, it is not wise to take precipitately the irrevocable step.

There are yet other cases in which the medical and ethical elements tax the judgment. Thus a woman is pregnant by a syphilised and maniacal husband. She dreads bringing into the world a child that may inherit these diseases.

Another case: A woman has had two pregnancies; both produced twins and flooding so severe as nearly to cost her life. Pregnant a third time, she asks to have abortion induced, urging that she is going to a colony beyond reach of skilled physicians.

Another case: A lady had puerperal mania; she recovered, and had insanity when not pregnant. This attack yielded quickly under rectification of uterine displacement; again pregnant, insanity returned at five months. Should labour be induced?

These cases all occurred in practice. In one case of recurrent purperal insanity, Spencer Wells removed the ovaries

in order to obviate the risk of another pregnancy and the probable concomitant insanity. It is difficult to contest the legitimacy of this proceeding. But several nice questions arise out of it. 1. It is assumed that another pregnancy will bring back insanity, and that without pregnancy the probability is sufficiently strong that she will not lapse into insanity. But ovariotomy simple has on several occasions been quickly followed by insanity. Then, again, oöphorectomy is not free from danger to life. Supposing the chances of death under the operation, and of recurrence of insanity if the ovaries are not removed, to be equal, are we justified in pitting life against insanity? 2. Is there no other way of avoiding pregnancy? Abstinence on the part of the husband is surely more reasonable than mutilating the wife. At the same time it must be remembered that oophorectomy is justified by clinical experience as a life-saving resource against hæmorrhage and other dangers connected with uterine fibro-myoma.

The advance of gynæcologieal knowledge imports new views into obstetric praetice, and compels us to revise laws that seemed immutably settled.

The new questions thus forced upon our attention add irresistible weight to the rule urged by Denman and his contemporaries, namely, not to undertake the induction of abortion or labour without a formal and deliberate consultation. When we reflect upon the many and grave medical, legal, and moral points involved in the arbitrary interruption of gestation, we shall see abundant reasons for seeking counsel to avoid possible clinical error, and for sharing serious professional and social responsibility.

With one more reflection we conclude this subject and this work. Women who are suffering under the trials, physical and social, of pregnancy are apt to think that they have a claim to the application of the resources of science to relieve them. This belief may be honest; it may be inspired by fear that overpowers reason and conscience. Whatever the motive, whatever the circumstances, the physician to whom the suggestion is made should meet it by at once proposing a consultation. Thus a complete revision of all the factors of the problem, full deliberation, and well-balanced judgment will be ensured.

In this way he will set the question in all its gravity in the clearest light before those who consult him. He will show them that a step so important can alone be justified on the strict rules of medical science, guided by law social and divine; that the rules so based are designed in the best interests of the patient herself. And so will the physician, in acquitting himself of his duty to the State, to his profession, and to the patient, give proof of his conviction that medicine in its application to the relief of suffering humanity knows no law but that of Right.

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